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CARBON ADSORPTION AND ELECTRODIALYSIS
FOR DEMINERALIZATION AT SANTEE, CALIFORNIA

Henry Filar, Jr.

Santee County Water District

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16. Abstract

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electrodialysis pilot plant for the demineralization of lime treated tertiary effluent,
has been built and tested at Santee, California.

The average total chemical oxygen demand (COD) removal, by the entire carbon column,
was 57 percent with an average 30.9 mg/l influent and an average 13.4 mg/l effluent con-
centration. The average dissolved COD removal was 58 percent with an average 26.9 mg/l
influent and an average 11.4 mg/l effluent concentration.

The cost of the 100,000 gpd activated carbon plant, including the replacement of
expended carbon with virgin activated carbon, was 35.9 cents per 1000 gallons of product.

The electrodialysis pilot plant produced water near the Federal Public Health Service
Drinking Water Standards. Typical operation on clean membranes was 60 percent removal
of the total dissolved solids with an 1135 mg/l influent and a 455 mg/l effluent concen-
tration. Sulfuric acid flushes, enzymatic detergent flushes, and plant shutdowns were
effective in retarding the organic (fouling) and inorganic (scaling) buildups on the
membrane surfaces. An estimate for a 1.5 MGD electrodialysis plant, excluding brine
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CARBON ADSORPTION AND
ELECTRODIALYSIS FOR DEMINERALIZATION
AT SANTEE, CALIFORNIA

PB 220 360

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ABSTRACT

A 100,000 gpd activated carbon adsorption pilot plant followed by a 50,000 gpd electrodialysis pilot plant for the demineralization of lime treated tertiary effluent, has been built and tested at Santee, California.

The average total chemical oxygen demand (COD) removal, by the entire carbon column, was 57 percent with an average 30.9 mg/l influent and an average 13.4 mg/l effluent concentration. The average dissolved COD removal was 58 percent with an average 26.9 mg/l influent and an average 11.4 mg/l effluent concentration.

The cost of the 100,000 gpd activated carbon plant, including the replacement of expended carbon with virgin activated carbon, was 35.9 cents per 1000 gallons of product.

The electrodialysis pilot plant produced water near the Federal Public Health Service Drinking Water Standards. Typical operation on clean membranes was 60 percent removal of the total dissolved solids with an 1135 mg/l influent and a 455 mg/l effluent concentration. Sulfuric acid flushes, enzymatic detergent flushes, and plant shutdowns were effective in retarding the organic (fouling) and inorganic (scaling) buildups on the membrane surfaces. An estimate for a 1.5 MGD electrodialysis plant, excluding brine disposal costs, is 28.6 cents per 1000 gallons of product.

This report was submitted in fulfillment of Project Number 17040 FKG, Contract Number 14-12-444, under the sponsorship of the Environmental Protection Agency by the Santee County Water District. Work was completed as of April 1973.

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SECTION I

CONCLUSION: PART ONE

1. The average dissolved COD influent and effluent values for the virgin activated carbon cycle, at Santee, were 27.2 and 10.4 mg/l. The average dissolved COD influent and effluent values for the regenerated activated carbon cycle were 26.6 and 12.3 mg/l.
2. The Darco virgin activated carbon treated 19.9 MG of tertiary effluent and removed 61.8 percent of the applied dissolved COD. The regenerated Darco carbon treated 15.3 MG of tertiary effluent and removed 53.8 percent of the applied dissolved COD.
3. The dissolved COD removal efficiency for the virgin carbon cycle was 40.1 pounds per 100 pounds of carbon, and for the regeneration cycle, 23.4 pounds per 100 pounds of carbon. The 21.3 percent decrease in pounds of COD removed per 100 pounds of carbon was mostly due to a 25 percent loss in activated carbon during regeneration.
4. Difficulties in removing the expended carbon from the lead contactor disk shaped vessel floor were responsible for 8 to 10 percent of the 25 percent carbon loss during regeneration.
5. After regeneration, there was a continuous loss of carbon fines in the backwash effluent.
6. An acid flush of the regenerated carbon, after 15.3 MG of water had been treated, significantly reduced the amount of carbon fines lost in the backwash effluent.
7. The partially estimated total cost of the carbon adsorption treatment of 100,000 gpd for the 18 month study period at Santee is 32.65 cents per 1000 gallons. This cost includes the replacement of expended carbon with virgin carbon.

SECTION II

CONCLUSIONS: PART TWO

1. The 50,000 gpd electrodialysis plant, at Santee, California, demineralized lime treated tertiary effluent. The water produced by the electrodialysis plant was consistently lower in total dissolved solids than the Colorado River drinking water, which was supplied to the community of Santee.
2. The electrodialysis plant consistently produced water equal to or slightly above the Public Health Service Drinking Water Chemical Standards.
3. Organic membrane fouling, which was easily removed by hand, was the major cause of run termination and membrane stack handcleanings.
4. Flushing the membrane stack with dilute sulfuric acid or enzymatic detergent, and shutting the pilot plant down for periods of time significantly reduced the rate of organic and inorganic buildup on the membrane surface.
5. The above methods used for the rejuvenation of membrane performance greatly reduced the frequency of membrane stack handcleanings.
6. At Santee, sulfuric acid flushes, enzymatic detergent flushes, and shutdowns were most effective when used in a regular frequency which was maintained without interruptions.
7. No permanent changes in the membrane characteristics were observed during the study period.
8. The total estimated cost of a 50,000 gpd electrodialysis demineralizer at Santee is \$1.04 per 1000 gallons of product.
9. The total cost of a 1.5 MGD electrodialysis demineralizer, based on Santee and using chemical adjustments, is estimated to be 28.6 cents per 1000 gallons of product. The same estimates based on a demineralizer which uses stream and current reversal is 26.8 cents per 1000 gallons of product water.

SECTION III

INTRODUCTION

A pilot plant demonstration project for the demineralization of tertiary effluent has been completed at Santee, California. The program was funded by the Environmental Protection Agency under a demonstration contract. The Santee plant included a 100,000 gpd carbon adsorption unit followed by an Ionics 50,000 gpd electro-dialysis demineralizer. The pilot plant demonstrated that water could be produced of equal or lower salt content than the Colorado River drinking water supplied to the community of Santee. The water produced by the pilot plants also came near or met the Public Health Service Drinking Water Chemical Standards.

THE RECLAIMED WATER SYSTEM AT SANTEE

The Santee County Water District, a public agency, provides water and sewage service for an unincorporated suburban community. As of 1970, the District encompassed 14,500 acres, twenty miles inland from the Pacific Ocean, near San Diego and El Cajon (1). The area has a semi-arid climate, receiving a mean of 13.7 inches annual rainfall.

Because of favorable geological conditions and water costs, in 1959, the Santee County Water District developed a plan to produce effluent of higher quality than efficient primary and secondary sewage treatment. The plan called for the reclamation of the effluent for a series of recreational lakes. A research program conducted from 1962 to 1965 studied the public health hazards and public acceptance of the reclaimed water. Upon completion, the District was allowed to use the lakes for public boating, fishing, and, in a pool adjacent to the lakes, swimming (2). This program received national attention and involved health agencies from the national to the local level.

The research at Santee was continued further with studies to compact the secondary plant and the reclamation system into one treatment center. This plan included a 4 mgd primary and secondary treatment plant followed by a 2 mgd tertiary treatment plant. In August 1966, Santee received an Environmental Protection Agency Public Law 660 Grant to assist in the construction of the 4 mgd activated sludge treatment plant. The facility was completed and placed in operation in January 1968.

THE DEMONSTRATION GRANT

In December, 1966 Santee received an \$800,000 demonstration grant from the Environmental Protection Agency (EPA). This grant was EPA partial cost support for the construction and 2-year demonstration of the advanced waste treatment plant. The construction was com-

pleted, and the tertiary plant put into operation in October, 1969. The testing and demonstration program ended in October, 1971 (3).

The 2 mgd tertiary treatment plant followed the activated sludge plant. It was designed for the removal of phosphorous and suspended solids, and consisted of a reactor-clarifier for slaked lime, polyelectrolyte, and alum, a recarbonation unit which supplied carbon dioxide by the combustion of natural gas, and two anthracite-sand gravity fed rapid filters. Chlorination basins for the disinfection of the effluent and study ponds for the observation of algae growth followed the rapid gravity filters.

PILOT PLANT STUDIES

Santee County Water District, and most water agencies in Southern California, receive their drinking water from the Metropolitan Water District of Southern California, Colorado River aqueduct system. The trend of this water has been a gradual increase in the total dissolved solids (TDS). In 1970 and 1971 the Santee drinking water was between 850 and 950 mg/l TDS. As this water passed through the homes of Santee and returned to the treatment plant, it gained an average of 400 mg/l TDS.

A program to demonstrate the demineralization of the tertiary effluent at Santee was included in the advanced waste treatment plan. Projected Colorado River drinking water costs and its steadily decreasing quality deemed a field test in order. Previous uses of the reclaimed lake water had been limited to recreation, golf course irrigation, and the irrigation of high salt tolerant crops not intended for human consumption. Successful demineralization of the reclaimed water would eliminate one of the main barriers for its supplemental use in the irrigation of salt sensitive crops. Virus studies similar to those in the original Santee project would be necessary before the demineralized water could be used either in the potable water system or for the irrigation of edible crops.

In order to study the demineralization of the tertiary effluent, concurrent with the demonstration grant of December, 1966 the Environmental Protection Agency funded a \$186,000 contract for the pilot plant electrodialysis demineralization demonstration project. The contract included a carbon adsorption unit capable of processing 100,000 gpd. This unit consisted of three columns filled with Darco granulated activated carbon which provided pretreatment for the 50,000 gpd Ionics Mark III electrodialysis demineralizer.

A Southern California construction firm set up the carbon adsorption columns and installed the prefab skid which contained the electrodialysis hardware. The demineralizer was housed in a prefabricated aluminum self-framing building 15 feet by 36 feet with a 12 foot ceiling. Construction was completed in October, 1969. Operation of

the carbon adsorption began in January, 1970. The startup of the electrodialysis pilot plant followed in February, 1970.

SCOPE OF WORK

The carbon adsorption columns, filled with 8 x 30 mesh Darco activated carbon, were used as pretreatment for the electrodialysis plant. In this capacity the following were to be determined:

1. The hydraulic application rate (gpm/ft²), detention time, and the backwash and recharge frequency.
2. The carbon adsorption rate (lbs COD removed per 100 lbs carbon).
3. The carbon exhaustion rate (lbs carbon per MG water treated).

Influent and effluent turbidity (JTU) and color (CU) were monitored during the project period.

Studies on the electrodialysis process encompassed:

1. Determine pressure changes, membrane resistance, and ampere changes.
2. Determine best practical methods to reduce fouling and control of items in number 1 for optimum performance.
3. Determine chemical requirements and membrane replacement needs for optimum removal of dissolved solids.
4. Compare product water quality with the Santee Colorado River drinking water and with the Public Health Service Drinking Water Standards.

APPROACH TO THE STUDY

The pilot plant was operated as part of the advanced waste treatment demonstration project. It was not a technical research program, but a demonstration that quality water could be produced. No highly trained professional personnel were used in its daily operation. Maintenance problems were usually handled by the Santee maintenance crew and the district electrician.

In February, 1970 an Ionics representative and a fulltime Santee employee began operation of the electrodialysis plant. The operator, using the operational manual and occasional contacts with Ionics, maintained direct operation and kept all log books until January, 1971.

In April, 1970 after the pilot plant startup, the operator and the Santee laboratory staff initiated the test program provided in the contract objectives. These goals and schedules were maintained until the assistant project engineer was hired in June, 1970.

Soon after June, 1970 detailed evaluation of the electrodialysis plant performance began. Twice weekly laboratory schedules and operational logs were set up to establish the performance parameters. All direct operation and logs were kept by the Santee operator until January, 1971. At this time the assistant project engineer took over direct operation and performance evaluation, and continued until the project ended in June, 1971.

All items in the carbon adsorption scope were closely followed. In light of the Pomona study (5), a key study which showed self-attrition, efficiency, and economical problems with the Darco carbon, emphasis was placed on the carbon adsorption rate, exhaustion rate, and the backwash frequency of the first column. This was done in order to add more data to the field performance of the Darco carbon. The carbon adsorption unit effluent was evaluated mostly as the electrodialysis influent.

Because of the length of the carbon adsorption section, the body of the report has been divided into two parts. The first part is the carbon adsorption data and results. The second, the electrodialysis data and results. Each section has separate conclusions provided in the front of the report.

The study of the electrodialysis process emphasized the determination of parameter changes, practical methods to reduce fouling, chemical requirements, and product water quality and characteristics. These items were treated in detail, while membrane replacement was only touched upon. An accurate determination of membrane replacement was limited by the short program, February, 1970 to June, 1971. The manufacturer suggests a much longer membrane life.

SECTION IV

PRETREATMENT

SECONDARY TREATMENT

The 4 mgd activated sludge treatment plant processed domestic sewage during the study period. The secondary effluent flowed into the lagoons, percolation basins, and the lakes. Before the lagoons, a portion of the effluent was taken into the 2 mgd tertiary system. Figure 1 presents the general flow pattern.

TERTIARY TREATMENT

Secondary effluent was treated with lime in a solids contact reactor-clarifier. The pH was adjusted by carbon dioxide in separate basins. It was then filtered in dual media (anthracite-sand) gravity filters. The filtered water flowed into several lagoons for storage before being discharged into the percolation basins.

QUALITY OF WATER TREATED

Santee's secondary effluent, tertiary effluent, and Colorado River drinking water are compared in Table 1. The secondary and tertiary samples were averages of twice weekly twenty-four hour composites and the potable samples were grab samples. The tertiary effluent water varied from 414 to 492 mg/l TDS greater than the Colorado River drinking water used by Santee.

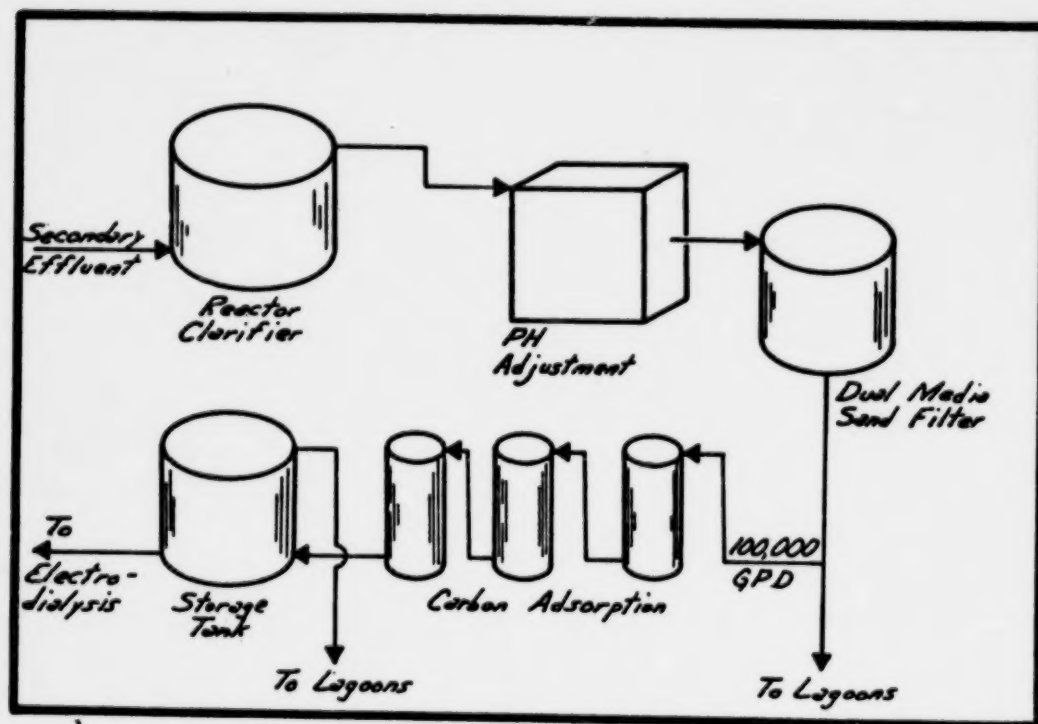


*Figure 1. Tertiary Flow Pattern
at Santee, California*

TABLE 1
SECONDARY AND TERTIARY EFFLUENT AND AQUEDUCT COLORADO RIVER DRINKING WATER AT SANTEE, CALIFORNIA

Test - as mg/l	Nov 1970 - Dec 1970 Secondary Tertiary Potable	Mar 1971 - May 1971 Secondary Tertiary Potable	May 1971 - Aug 1971 Secondary Tertiary Potable
Calcium-Ca	94	106	87
Magnesium-Mg	42	26	33
Total Hardness-CaCO ₃	406	370	352
Sodium-Na		238	112
Potassium-K		19	6.4
Total Kjeldahl-N	15.6	13.0	
Ammonium-NH ₄	9.9	8.4	1.3
Nitrate-NO ₃	0.7	0.7	0.13
Nitrite-NO ₂	2.1	0.3	
Sulfate-SO ₄		359	385
Chloride-Cl		252	101
Total Phosphate-P	13.9	1.1	0.1
Ortho Phosphate-P	12.3	0.7	
Alkalinity-CaCO ₃	231	220	141
pH (units)	7.4	8.4	
Suspended Solids	54	34	
Volatile Suspended Solids			
Turbidity (J.T.U.)	27	30	
BOD	36	10.1	
COD	69.2	38.2	
COD (Filtrate)	51.6	36.8	
ABS	0.5	0.2	
Iron-Fe		0.1	0.08
Total Dissolved Solids		1264	850
micromhos/cm		1607	1058
Color (units)	38	26	

SECTION V

PART I: CARBON ADSORPTION

The carbon adsorption pilot plant at Santee supplied pretreated water to the electrodialysis unit. The facilities included three carbon vessels for contactors, containing approximately 12,000 pounds of Darco activated carbon. The unit treated 100,000 gallons of tertiary dual media filter effluent per operating day. The carbon adsorption product water discharged into a 4500 gallon storage tank provided with an overflow into the secondary effluent oxidation pond.

APPROACH TO STUDY

The original operational program at Santee called for the replenishment of expended carbon with virgin carbon. The small size of the plant, 100,000 gpd, made this method economically feasible compared to the capital costs involved with on site regeneration. However, because of the cooperation of Atlas Chemical Industries (Wilmington, Delaware), the spent carbon in the lead contactor was regenerated one time during the year and one-half study period.

The original operational program was as follows: The columns were to be rotated so each vessel would occupy the lead position once every three cycles. For example, when the lead contactor carbon was expended, it would be replaced with virgin carbon and placed in the tail position (Figure 2). The middle contactor would then be shifted into the lead position and the tail contactor shifted into the middle position. The position of each contactor would rotate in this manner as each lead contactor carbon was expended.

At the end of the virgin cycle in November, 1970 the lead contactor expended carbon was not discarded, but rather, loaded into 55 gallon drums and shipped to the Atlas Chemical Industry regeneration facilities in Marshall, Texas. After regeneration, the carbon was returned to Santee and loaded into the original lead contactor. This, in effect, accelerated the rotation cycle by three cycles. The second and third contactors also remained in their original positions. Each of these vessels was replenished with virgin Darco carbon one time during the study period. This was done in order to maintain good quality water for the electrodialysis facilities.

Because the original study program was changed and the regeneration program developed, data taking and performance evaluation were focused on the lead contactor. Analysis of the main column effluent was treated as electrodialysis influent in the Electrodialysis Section, Part II.

FLOW PATTERN

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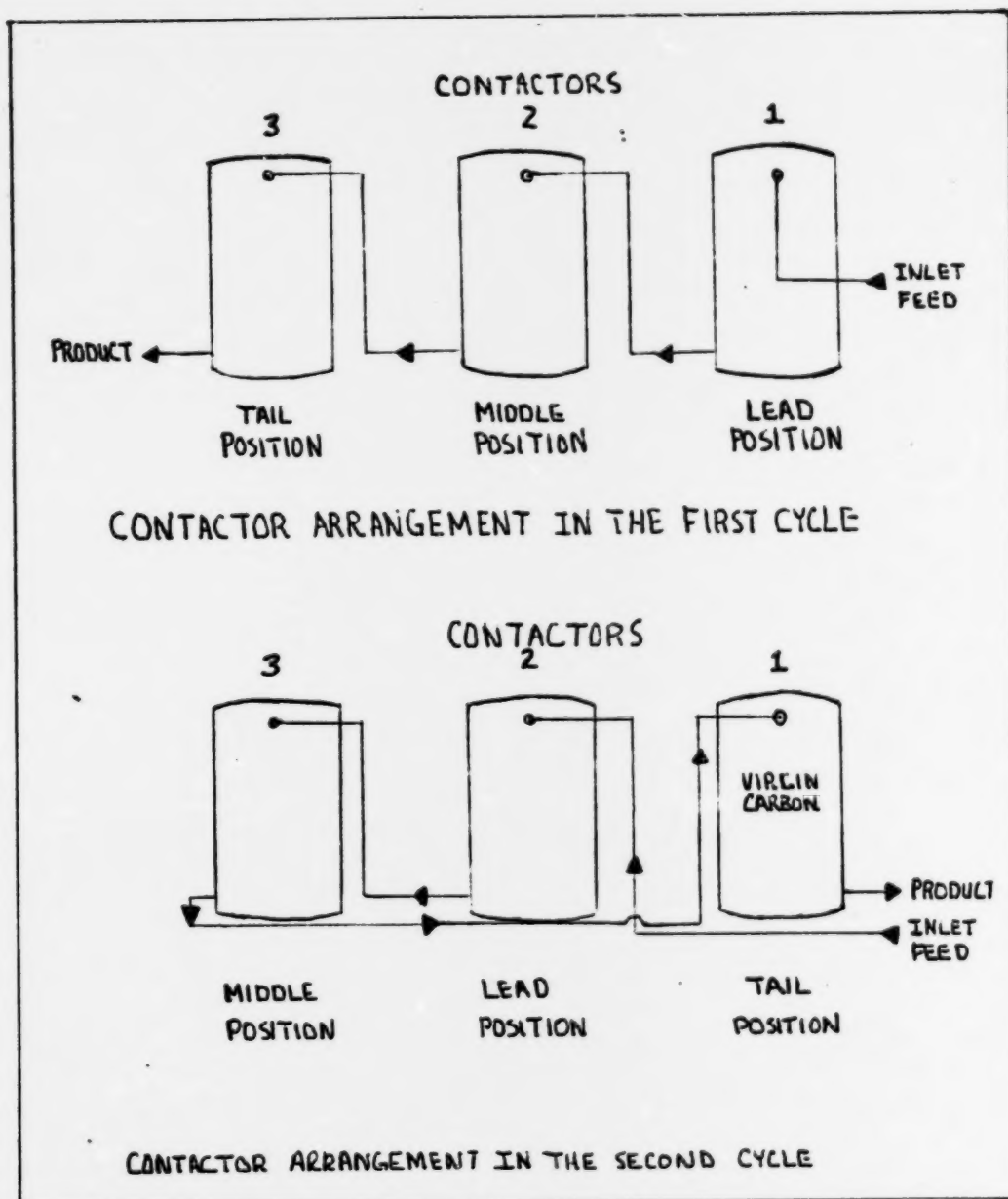


FIGURE 2. FIRST AND SECOND CYCLE CONTACTOR ARRANGEMENT UNDER NORMAL OPERATION.

A flow schematic is given in Figure 3. The pipe arrangement allowed the unit to operate in series with the contactors in 1-2-3, or 2-3-1, or 3-1-2 order. Feed water was initially drawn up from the tertiary effluent line by a 3/4-hp pump. Water flowed into each contactor at 70 gpm or at an application rate of 2.1 gpm/ft^2 (1.436 l/sec/m^2). Detention time for the lead contactor empty bed volume was an average 17 minutes, and for the three carbon contactors, 50 minutes. Product water gallonage was kept by a flow totalizer located between the carbon unit and the post-carbon storage tank.

The upflow backwash system is also diagramed in Figure 3. A 3-hp pump provided the flow. During the virgin carbon cycle, in 1970, water was drawn from the tertiary effluent line at an application rate of 6.2 gpm/ft^2 . However, in February 1971, the backwash inlet was relocated into the base of the recarbonation basin. This change provided a net input positive head, and allowed application rates up to 9.2 gpm/ft^2 . The backwash effluent discharged into the oxidation pond immediately following the tertiary plant.

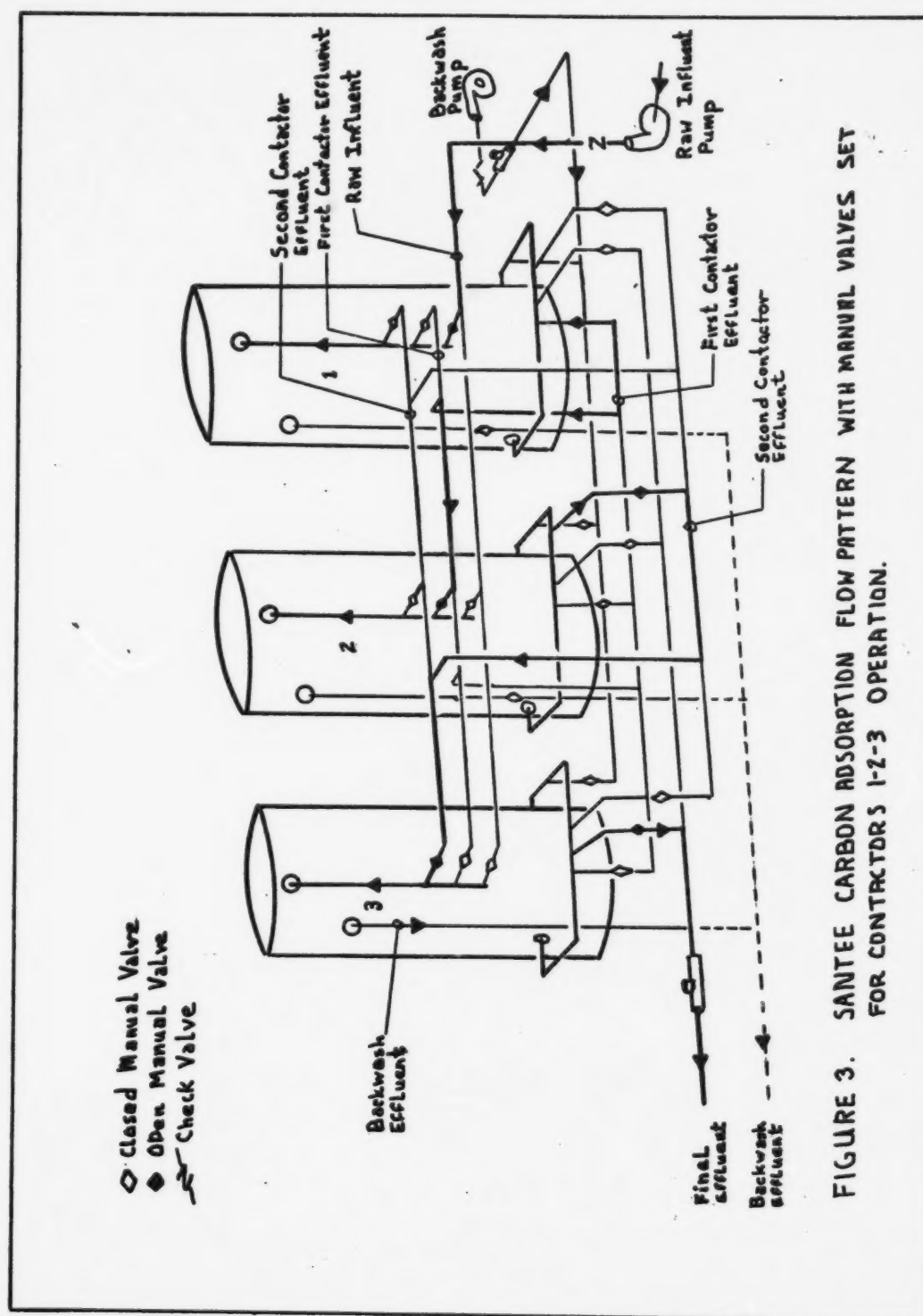
Inlet and outlet 0-15 psi gauges were used to measure the pressure differential across the lead contactor. The pressure differential before backwashing ranged from a low of 2 psi to a high of 13 psi. Pressure differentials after backwashing were between 2 and 3 psi.

CONTACTORS

A diagram of a Santee carbon contactor is shown in Figure 4. Each vessel stood ten feet (3.05 m) high and 6.5 feet (1.98 m) in diameter. Each vessel contained approximately 4.75 feet (1.45 m) of activated carbon, with an average 4000 pounds per contactor. The bed of activated carbon rested on a dish shaped perforated steel plate with a depth of one foot. There were 89 perforations with each containing a screen nozzle. Water flowed down through the top of the nozzles during normal operations and upflow while backwashing. Carbon was unloaded for disposal by discharging a water-carbon slurry through a 6 inch nozzle located just above the dish plate.

CARBON PHYSICAL CHARACTERISTICS

Atlas Chemical Industry, Inc. supplied the activated carbon for the study at no cost. In January 1970, operations began with 12,000 pounds of Granular Darco 8 X 30 activated carbon. Carbon physical characteristics are given in Table 2. In November, 1970 the spent carbon in the lead contactor was unloaded and shipped to Marshall, Texas, where it was regenerated at the Atlas activated carbon pilot plant site. The regenerated carbon was returned in January 1971 and loaded into the same lead contactor. Regenerated carbon physical characteristics can also be seen in Table 2. Details of regeneration can be found in Table 3. The Atlas Chemical Industries representative reported a 90.7 percent recovery of the spent carbon after regenera-



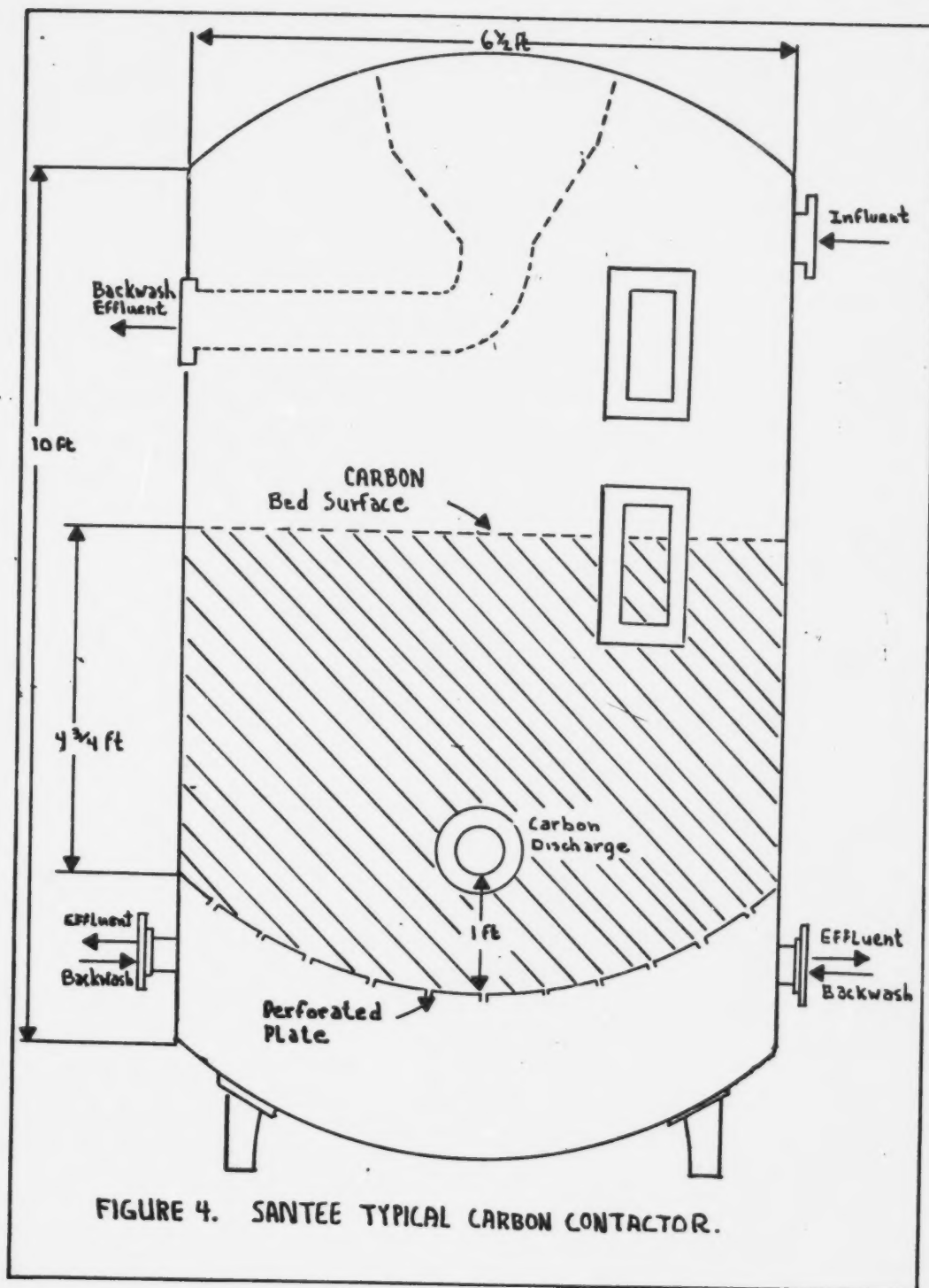


FIGURE 4. SANTEE TYPICAL CARBON CONTACTOR.

TABLE 2 CARBON PHYSICAL CHARACTERISTICS*

	Virgin Darco 8x30	Spent Carbon	Regenerated Carbon
Vibrating feed apparent density	0.387	0.438	0.415
Molasses relative efficiency	118	66	100
Surface area m ² /gm	594	378	524
% Dust	0.15	0.08	0.14
% Ash dry basis	14.6	11.4	12.8
% Water solubles, dry basis	1.12	1.92	1.60
pH	4.4	5.8	8.4
Screen analysis (U.S. Std.), Wt %			
+ 8	0.2	0.2	0.2
8 x 12	16.4	14.3	11.0
12 x 16	28.7	28.8	29.6
16 x 20	31.0	34.0	35.2
20 x 25	11.7	11.0	11.3
25 x 30	9.2	10.0	10.5
- 30	1.3	1.6	2.2

* Data taken from correspondence with Mr. James Black of Atlas Chemical Industries, Inc., Wilmington, Delaware, 6 May 1971.

TABLE 3 CONFIGURATION OF THE EXTERNALLY FIRED ROTARY TUBE FURNACE AND OPERATING CONDITIONS UNDER WHICH THE SANTEE CARBON WAS REGENERATED.*

Tube internal diameter	14.5 inches
Tube length	13.5 feet
Tube slope	0.125 inches/foot
Tube revolution rate	8 rpm
Average feed rate	845 pounds/hour
Average feed moisture	50.8%
Average discharge rate	350 pounds/hour
Average furnace temperature	981°C
Average steam rate	122 pounds/hour
Average discharge vibrating feed apparent density	0.393 gm/ml

* Data taken from correspondence with Mr. James Black of Atlas Chemical Industries, Inc., Wilmington, Delaware, 6 May 1971.

tion.

OPERATION PROCEDURES

The daily operation of the pilot plant was maintained by the electro-dialysis operator, and consisted of record keeping and lead contactor backwashing. Feed pump hour and product gallonage totalizer readings were taken five days a week between 7 and 8 a.m. Also at this time, the product flow rate and the pressures across the lead contactor were recorded and correlated to determine whether the lead contactor needed backwashing. The operator spent between 10 and 30 minutes per working day on these duties. The flow and pressures were monitored twice every evening and night shift by the plant attendant on duty.

LABORATORY METHODS

Twenty-four 500 ml hourly samples were composited every Monday and Wednesday. The composites were automatically collected by sample pump-timer units and stored in refrigerators. Samples were gathered by the electrodialysis operator between 7 and 8 a.m. every Tuesday and Thursday, and immediately taken to the laboratory for analysis. A minimum testing schedule is given in Table 8 in the Electrodialysis Laboratory Section.

The methods for most of the tests were taken from the 1965 Standard Methods (6) and the FWPCA Manual (7). A detailed enumeration of each test procedure is given in Table 9 in the Electrodialysis Laboratory Section.

LEAD CONTACTOR PERFORMANCE

A definite decline in the lead contactor performance was experienced after the regeneration of the Darco carbon. The virgin carbon treated 19.9 MG of tertiary water and removed 36.3 percent of the applied dissolved COD. During the regeneration cycle, 15.3 MG of water were treated with the dissolved COD removal decreasing to 21.3 percent. A description of each cycle performance follows.

Virgin Carbon Cycle

Performance of the virgin Darco carbon and the lead contactor is summarized in Table 4. During the 210 days of operation, 40.1 pounds of the applied dissolved COD were removed. The 19.9 MG treated were delivered at an average application rate of 2.0 gpm/ft² (1.36 l/sec/m²). The average detention time of the lead contactor empty bed volume was 19 minutes. The carbon dosage at the time of the lead contactor unloading, was 205 pounds of virgin carbon per MG of water treated.

Removal efficiencies of the virgin Darco carbon are given in Table 5. The lead contactor removed 38.7 percent of the applied total COD and 36.3 percent of the applied dissolved COD. The average lead contactor effluent turbidity was 0.8 JTU with a 1.5 JTU influent.

Total and dissolved COD influent and effluent concentrations are shown in Figures 5 and 6. The dissolved COD percent removals are depicted in Figure 7. When the data taking was initiated, the dissolved COD removal by the lead contactor was 57 percent. This parameter fell to 30 percent over the 11 month virgin carbon cycle. The removal initially declined rapidly and then leveled off around 30 percent. This leveling off has been found, by the Pomona studies (4), to be due to biological oxidation of the organic matter passing through the column. The percent removal by the entire carbon column is also included in the figure.

TABLE 4 LEAD CONTACTOR PERFORMANCE

	First Cycle Jan-Nov 1970 Virgin Carbon	Second Cycle Jan-June 1971 Regenerated Carbon
Days on Stream	210	158
Volume of Water Treated (MG)	19.9	15.3
Carbon Dosage Lbs carbon/MG Treated	205	201
COD Removal in Lbs Per 100 Lbs carbon:		
Total COD	50.3	25.7
Dissolved COD	40.1	23.4
Average Application Rate gpm/ft ²	2.0	2.2
Average Detention Time of Empty Bed Volume in min	19.0	15.0

The rate of the lead contactor COD loading is shown in Figure 8. COD loading is defined as the pounds of COD removed per 100 pounds of activated carbon. The curve is linear, indicating that the COD removal was fairly constant for each million gallons of water treated. Dissolved COD data did not begin until 4,000,000 gallons had passed through the columns. Before the cumulative loading values could be calculated, the dissolved COD curve was projected from the point of initial data taking to the origin.

Regenerated Carbon Cycle

The performance of the virgin carbon and the regenerated carbon are compared in Tables 4 and 5. Dissolved COD removals, based on pounds of COD per 100 pounds of carbon, declined from 36.3 to 21.3 percent

TABLE 5 LEAD CONTACTOR REMOVAL EFFICIENCIES

	First Cycle Jan-Nov 1970 Virgin Carbon	Second Cycle Jan-June 1971 Regenerated Carbon
Average Influent Total COD mg/l	31.6	31.4
Average Influent Dissolved COD mg/l	27.2	26.6
Pounds of Carbon in Contactor Removal:	4080	3080
lbs Total COD/ 100 lbs Carbon	50.3	25.7
lbs Dissolved COD/ 100 lbs Carbon	40.1	23.4
% Total COD Removed	38.7	20.6
% Dissolved COD Removed	36.3	21.3
Average Influent Turbidity (JTU)	1.5	3.1
Average Effluent Turbidity (JTU)	0.8	1.3
Color Influent	22	25
Effluent	0.8	5.8

from the first to the second cycle. Lead contactor percent removals and influent and effluent dissolved COD's are given in Table 6A.

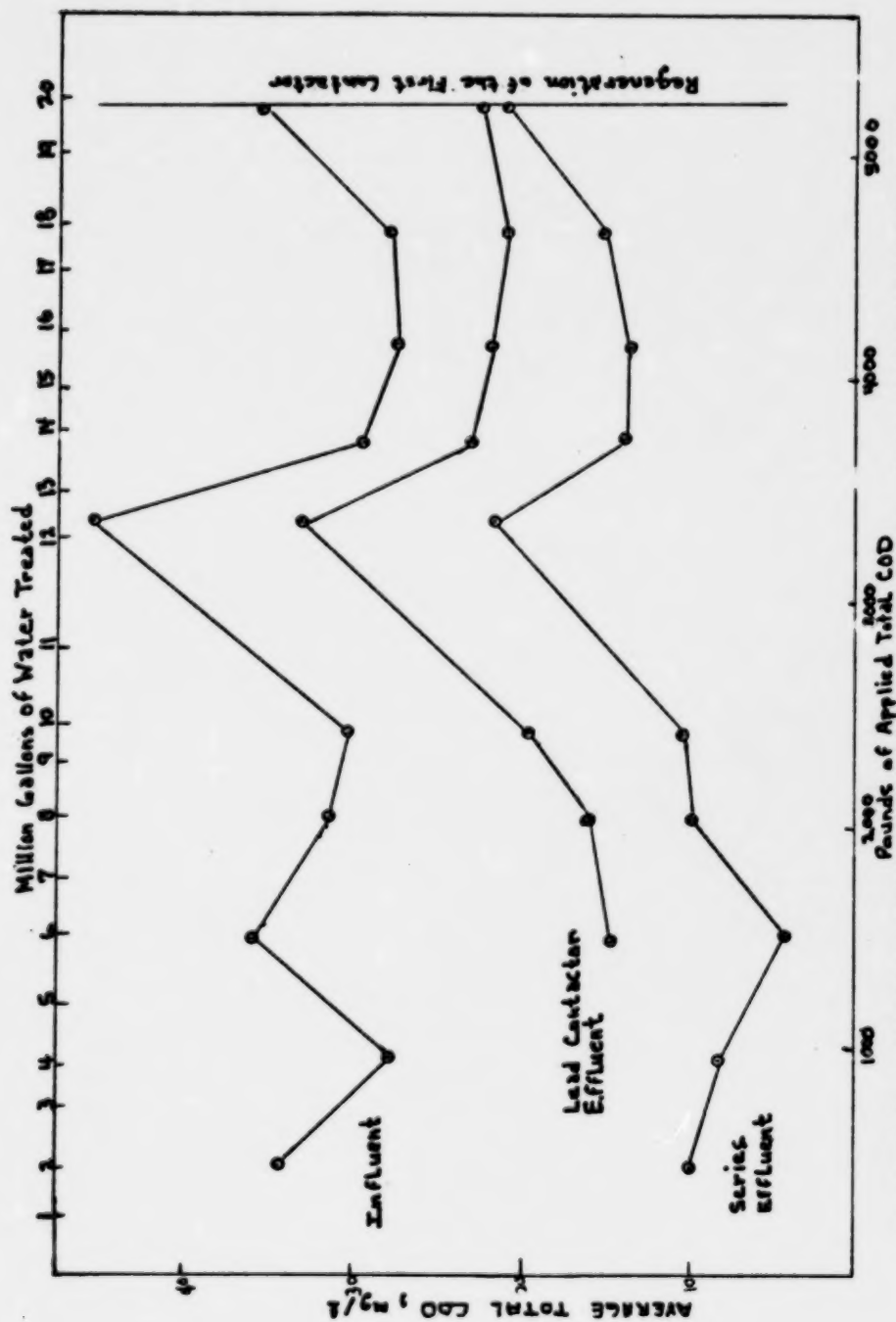


FIGURE 5. AVERAGE CARBON ADSORPTION INFLUENT, LEAD CONTACTOR EFFLUENT AND SERIES EFFLUENT TOTAL COD DURING THE FIRST CYCLE.

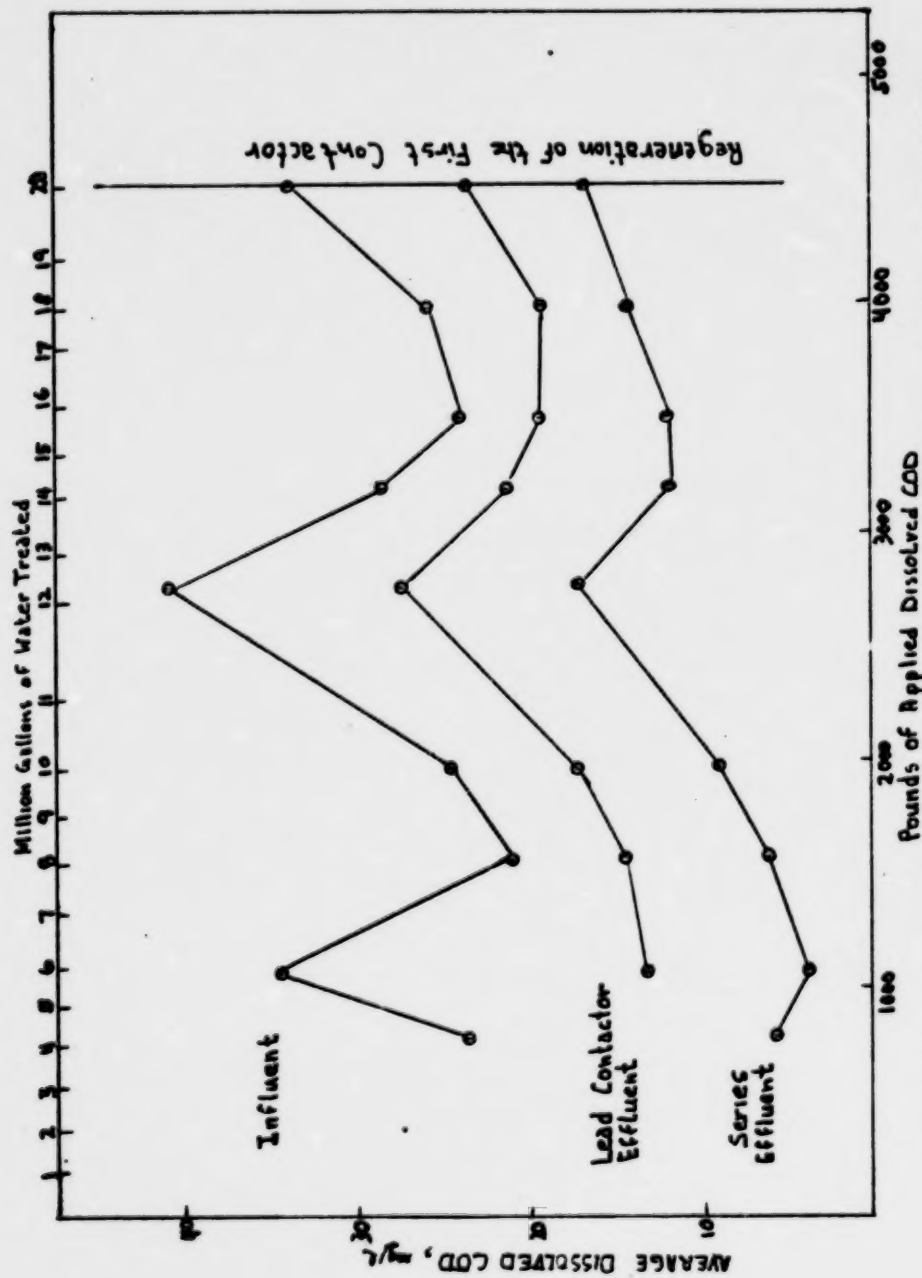


FIGURE 6. AVERAGE CARBON ADSORPTION INFLUENT, LEAD CONTACTOR EFFLUENT AND SERIES EFFLUENT DISSOLVED COD DURING THE FIRST CYCLE.

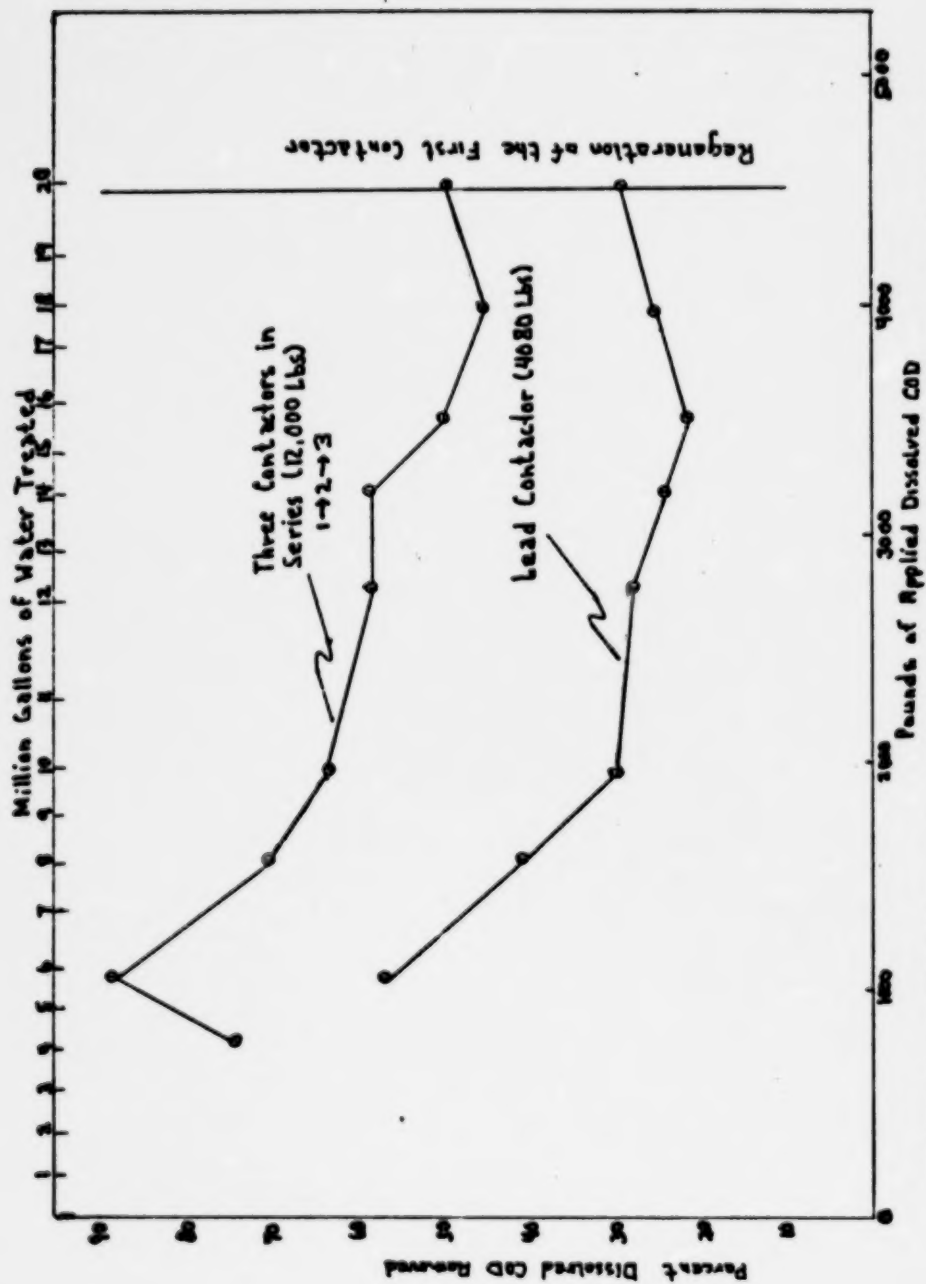


FIGURE 7. PERCENT REMOVAL OF DISSOLVED CAD BY THE THREE CONTACTORS IN SERIES AND THE LEAD CONTACTOR IN THE FIRST OR VIRGIN CARBON CYCLE.

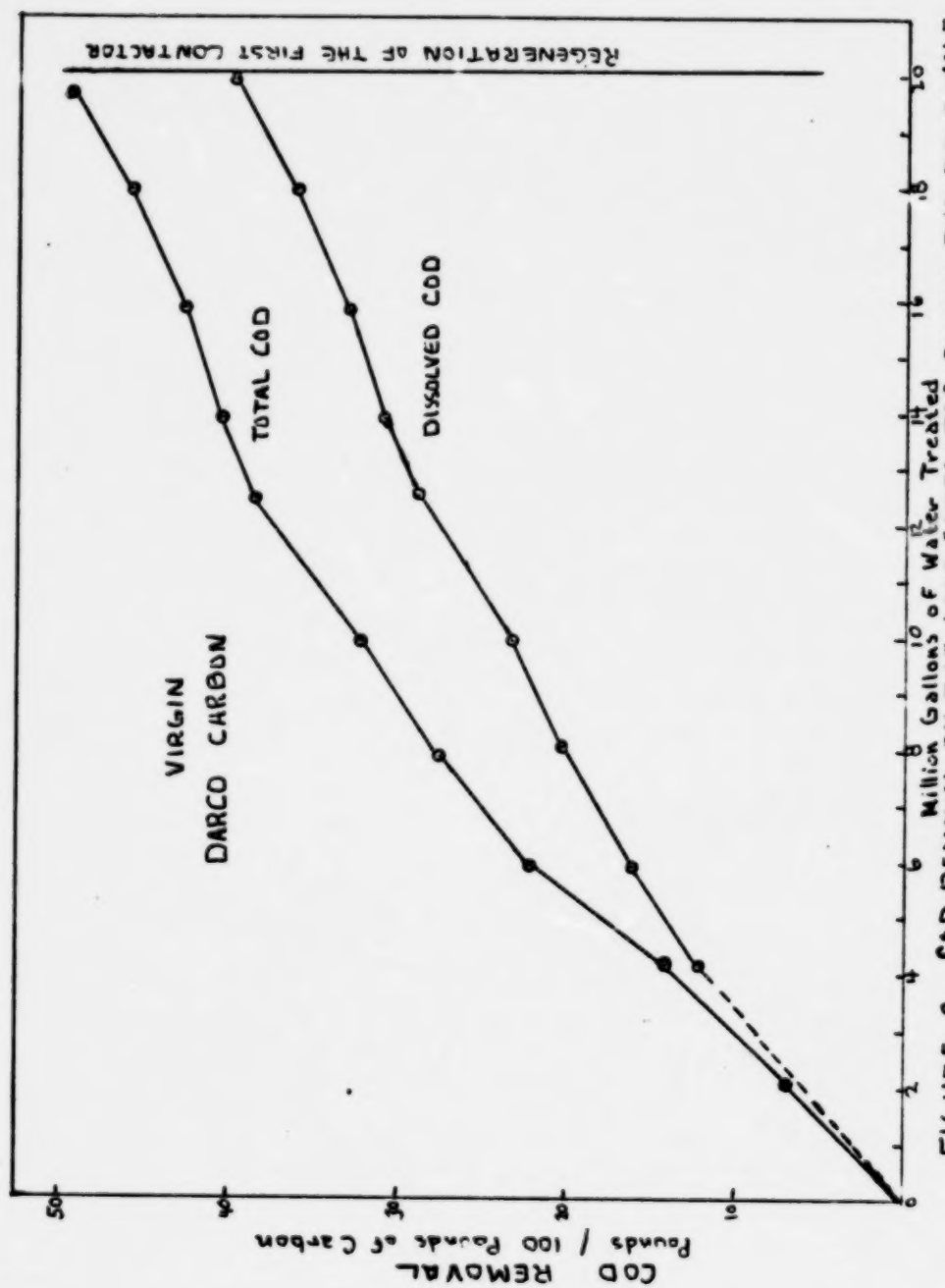


FIGURE 8. COD REMOVAL BY THE LEAD CONTACTOR DURING THE FIRST CYCLE.

TABLE 6A LEAD CONTACTOR DISSOLVED COD PERCENT REMOVALS

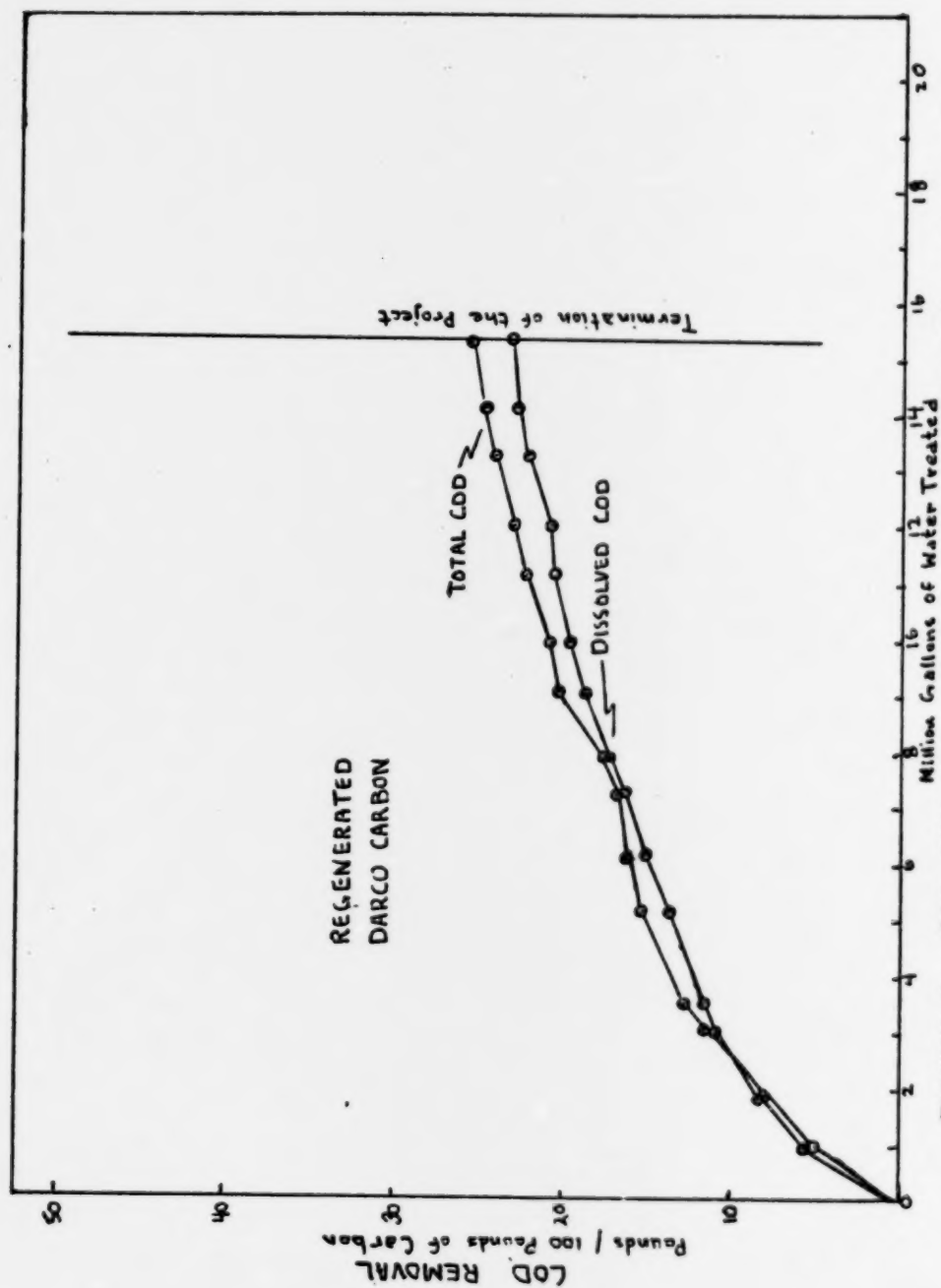
Cycle	Average Influent Dissolved COD, mg/l	Average Lead Contactor Effluent DCOD, mg/l	Lead Contactor Percent Removal
Virgin Carbon	27.3	17.4	36.3
Regenerated Carbon	26.7	21.0	21.3

Assuming that the pounds of dissolved COD removed per 100 pounds of carbon, during the regenerated carbon cycle, was constant from 15.3 MG to 19.9 MG (refer to Figure 9), the projected removals would have given a total of 27.2 pounds of dissolved COD removed per 100 pounds of carbon. This was a 32 percent drop in removal efficiency from the total 40.1 pounds of dissolved COD removed per 100 pounds of carbon of the first cycle. The lower removal efficiency was attributed to, first, the 25 percent loss in carbon experienced during regeneration, and second, the changes in the carbon adsorption properties which occurred during regeneration.

Dissolved COD percent removals by the lead contactor and the entire column during the second cycle are shown in Figure 10. Average influent and effluent dissolved and total COD concentrations are given in Figures 11 and 12.

Carbon Unloading Losses

Difficulties were encountered while transferring the carbon for regeneration. As explained in the Approach to Study Section, the small size of the Santee plant made it more economical to replace the expended carbon with virgin carbon. The unloaded carbon would have been discarded without regeneration. However, because of the cooperation of Atlas Chemical Industries and the availability of their regeneration facilities, a regeneration program was carried out. Upon unloading the expended carbon, the dish shaped perforated plate and the location of the discharge pipe (refer to Figure 4) presented problems in removing the entire carbon bed. Since the carbon slurry was loaded into 55 gallon drums for shipment, the flow necessary to lift the carbon out of the dish could not be handled without spilling most of the carbon. In an attempt to remove the carbon from the dish, the carbon was unloaded by hand. However, this procedure was soon halted because of fears of damaging the nozzles in the tank floor and of



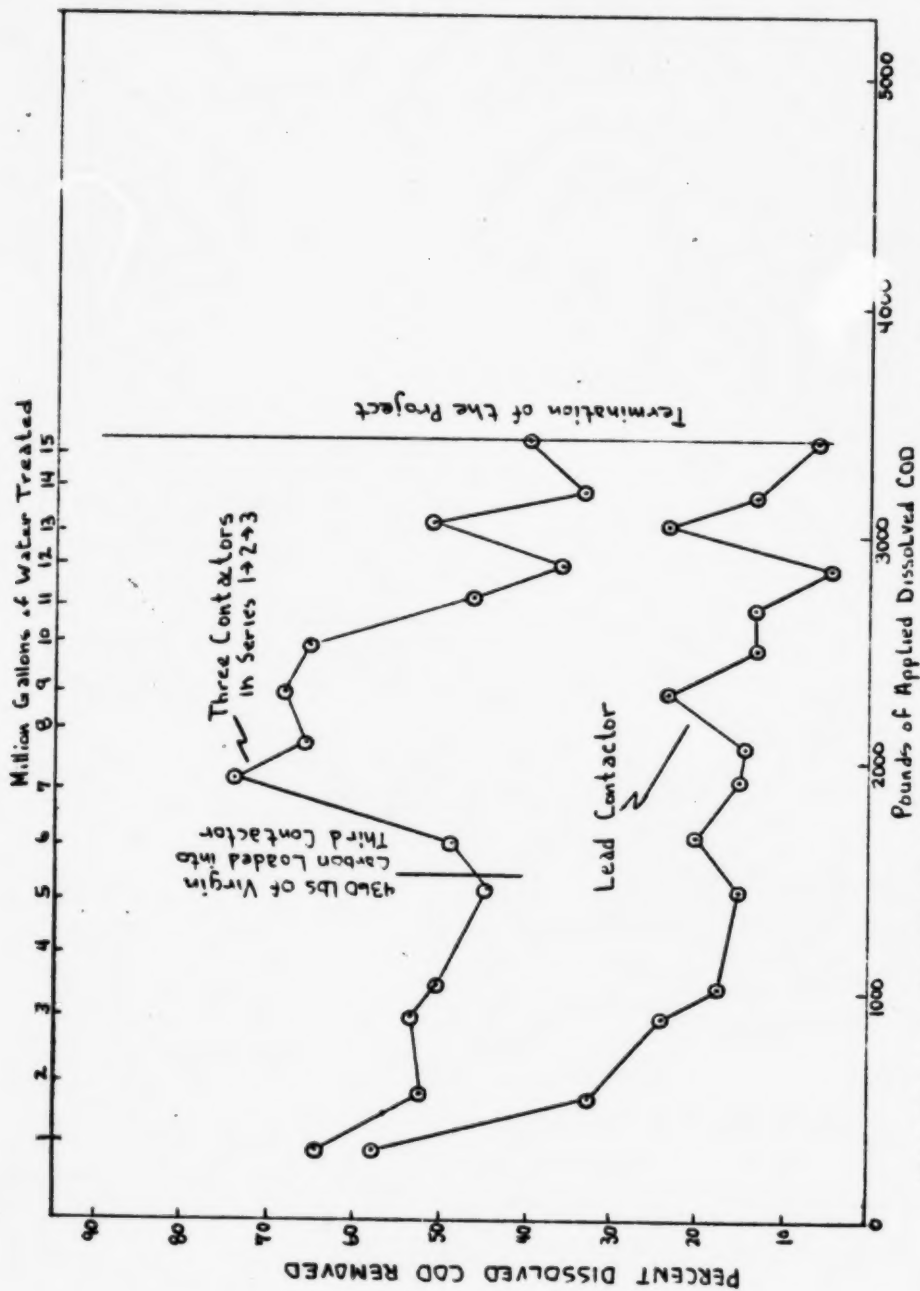


FIGURE 10. PERCENT REMOVAL OF DISSOLVED COD BY THE THREE CONTACTORS IN SERIES AND THE LEAD CONTACTOR DURING THE SECOND OR REGENERATION CYCLE.

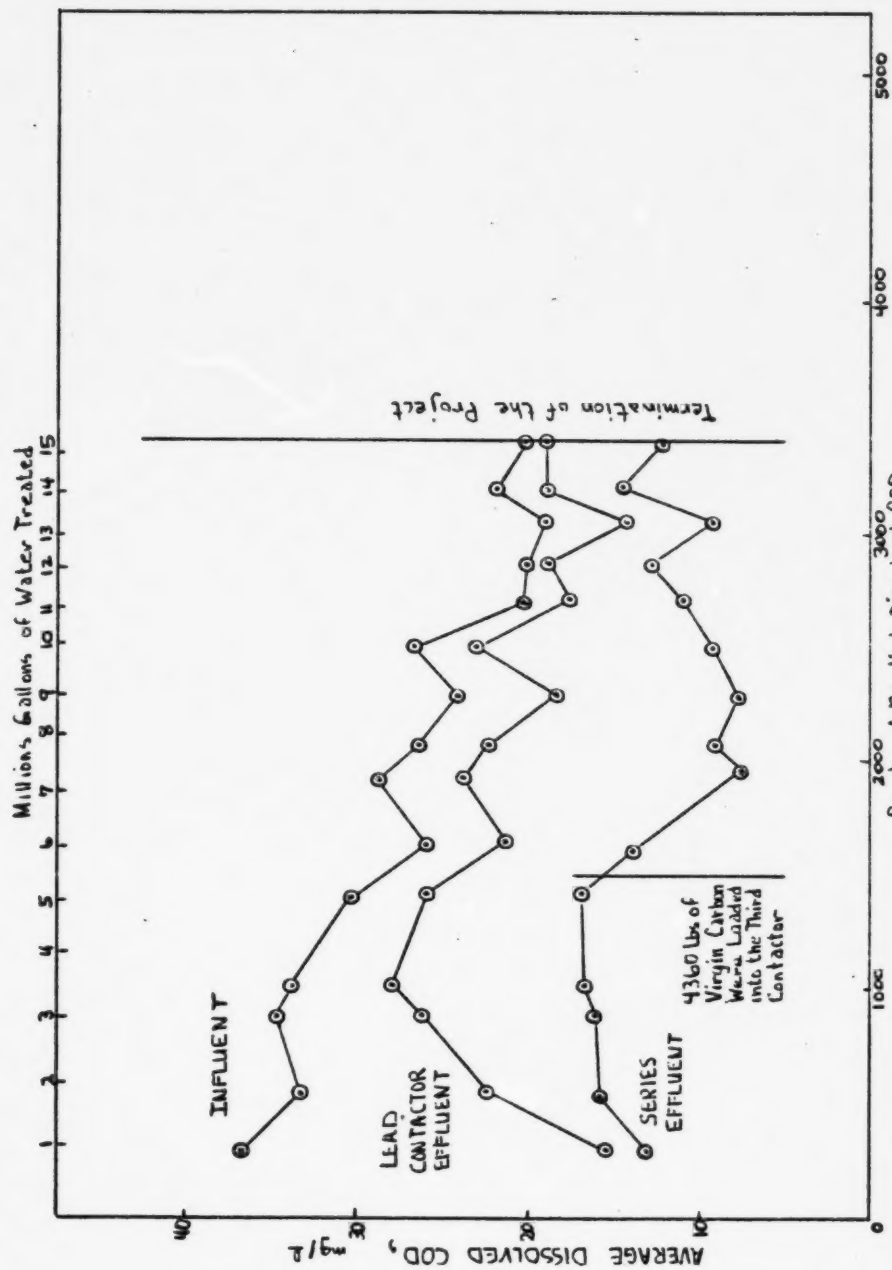


FIGURE 11. AVERAGE CARBON ADSORPTION INFLUENT, LEAD CONTACTOR EFFLUENT AND SERIES EFFLUENT DISSOLVED COD DURING THE SECOND OR REGENERATION CYCLE.

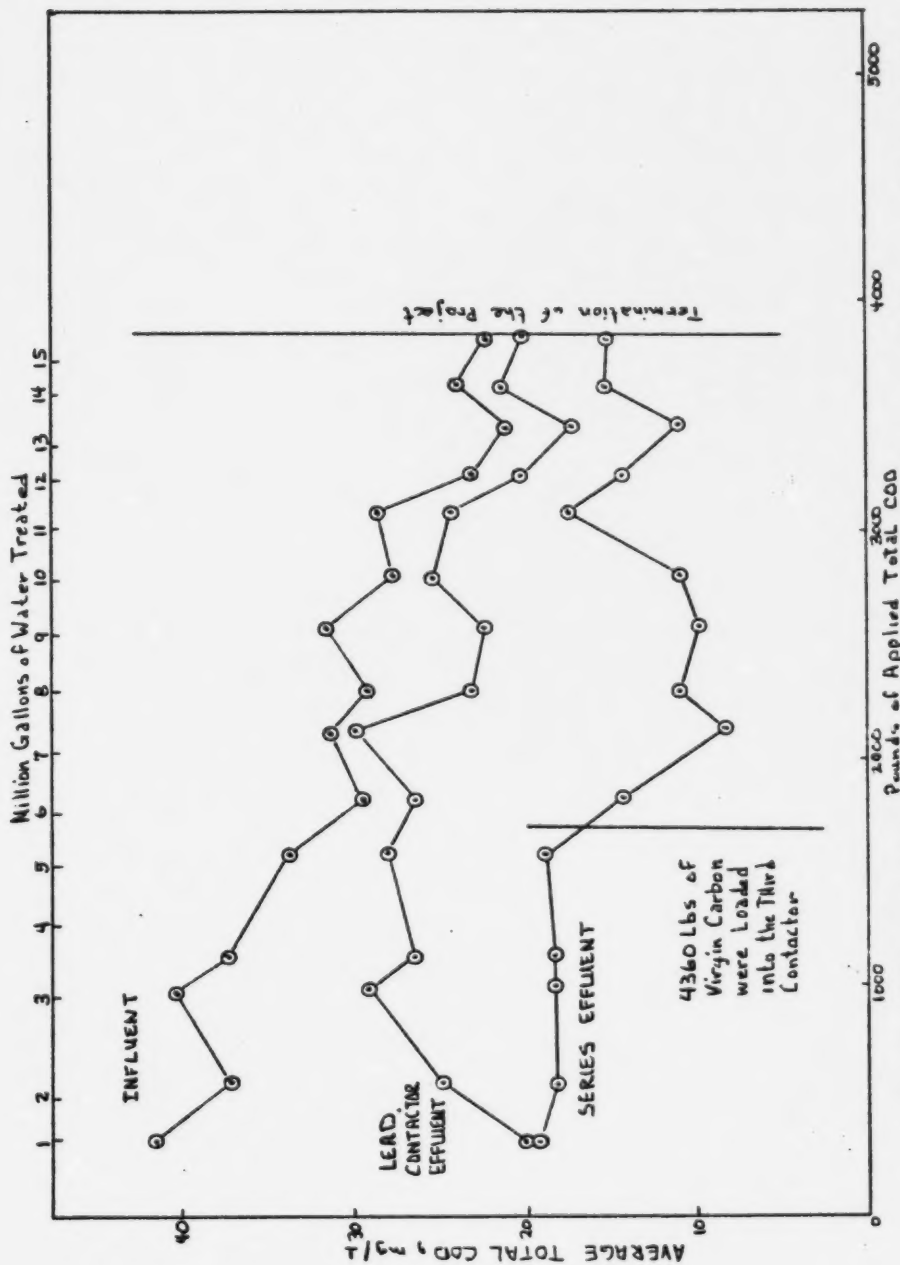


FIGURE 12. AVERAGE CARBON ADSORPTION INFLUENT, LEAD CONTACTOR EFFLUENT AND SERIES EFFLUENT TOTAL COD DURING THE SECOND OR REGENERATION CYCLE.

piercing the inside coating.

Part of the lower removal efficiency of the second cycle can be attributed to these unloading problems. The total of the carbon left in the dish, the carbon losses while loading the 55 gallon drums, and the regeneration losses were approximately 1,000 pounds. The net effect of these losses was to lower the bed height and to decrease the contact time from 19 to 15 minutes for the second cycle. The extent of the removal efficiency decrease brought about by the lower bed height and contact time is an empirical factor which cannot be predicted. Because of the nature of the effects, the exact removal efficiency decrease caused by either the carbon losses or the actual loss in adsorption properties after regeneration were not separated.

Backwashing and Head Loss

Three backwash programs were carried out during the study period. During the virgin carbon cycle, January to November 1970, the lead contactor was backwashed at 6.2 gpm/ft² (4.2 l/sec/m²) when the product flow rate fell below 70 gpm (4.4 l/sec), usually near 60 gpm (3.8 l/sec). Since pressure losses across the lead contactor during the virgin carbon cycle were low and steady, around 2 psi, the decline in product water delivery rate was used as the backwash criterion. The maximum flows in this period were around 75 gpm (4.7 l/sec) and the average flow rate was 66 gpm (4.2 l/sec). The total amount of tertiary effluent used for backwashing was 4 percent of the product gallonage.

The second backwash program ran from 15 February to 30 April 1971, in the first half of the regeneration cycle. At this time, the lead contactor was backwashed when the pressure loss reached 3 psi or greater; this meant a backwash almost every working day. Also within this period, the inputs to the backwash and the feed pumps were changed from negative to positive heads. These changes brought the backwash flow rates from 6.2 gpm/ft² (4.2 l/sec/m²) to 9.2 gpm/ft² (6.25 l/sec/m²), and the feed pump flow rates from 65-72 gpm (4.1 - 4.5 l/sec) to 80-85 gpm (5.1 - 5.4 l/sec). The average product flow rate for the entire period was 71 gpm (4.5 l/sec).

The second program of increasing the backwash frequency and operating the unit at maximum flow rates definitely increased the average product flow rate, and at the same time did not require much more operator man hours. The total backwash gallons for the period rose to 20 percent of the product gallons. No definite performance change accompanied the increased backwashing schedule.

The third period was initiated on 1 May 1971. Instead of a backwashing automatically every day, the pressure differential across the lead contactor was used as a criterion. After the feed pump flow rate increase in the second period, there was a slight increase in the pressure loss across the lead contactor after backwashing. This pressure differential rose from a range of zero to 2 psi, to a range

of 2 to 3 psi. Because of the higher feed pump flow rates, after 24 hours of operation, the pressure loss across the lead contactor had risen to 5 or 6 psi, where it had previously been only 2 to 3 psi. In order to adjust for these higher pressure losses, the lead contactor backwash criterion was increased to 4 or 5 psi. This meant a backwashing approximately every two days.

The product average flow rate during this final period was 72 gpm (4.5 l/sec). Total backwash gallons fell back to 4.5 percent of the product gallons.

Loss Of Carbon Fines In The Backwash Waste Stream

Immediately after loading the lead contactor with the regenerated carbon in January 1971, the column was backwashed at 6.2 gpm/ft² (4.2 l/sec/m²) for four hours. The backwash waste stream at the end of the four hours was clear of fine colloids, however, still contained some larger particles of carbon which settled out in approximately 24 hours. During the next month of operation, the fines were always present in the waste stream.

The Atlas Chemical Industries representative felt that the backwash flow rate was insufficient to remove the fines left from regeneration, and that a higher flow rate was needed to eliminate the particles from the backwash effluent. On 5 April 1971 the flow rate was increased from 6.2 gpm/ft² (4.2 l/sec/m²) to 9.2 gpm/ft² (6.25 l/sec/m²). The initial backwash effluent with the higher flow rates was fairly clear, but still contained small amounts of carbon particles. Also at this time, the upstream sand filters were sometimes bypassed and occasionally a layer of calcium carbonate floc from the reactor-clarifier accumulated on the bed surface. This layer was easily broken up and removed in the backwash waste stream.

Carbon fines were still present in the backwash effluent in mid-March. At this time, a sample of the backwash waste was sent to Atlas Chemical Industries for analysis. On 6 May 1971 Santee received their recommendations (10). Their analysis revealed that biological slimes growing on the carbon particles were adhering to their surfaces and lowering the settling rate. This bouyancy allow the particles to float out during backwashing. They also felt that the low backwash flow rates in the early part of the cycle were responsible for the excessive biological slimes.

Atlas Chemical Industries recommended several different methods to remove the slime. An acid soak was the most practical at Santee. During the last week of the project, twelve gallons of concentrated sulfuric acid were used to make a 2.4 pH acid flush. The acidic solution was injected upflow through the backwash pump, until the effluent pH was 3. The column stood for three hours. The unit was then backwashed and the effluent analyzed for suspended solids. At

the end of backwashing, the waste stream was noticeably clearer. Backwash effluent suspended solids data before the flush gave values in the 250 mg/l range. The day following the flush backwash effluent suspended solids were down to 40 mg/l.

Because the study ended on 2 June 1971, the long term effects of the acid flush on the loss of carbon fines in the backwash effluent were not known. The data accumulated at Santee revealed a loss of removal efficiency and presence of fines in the backwash effluent, during the regenerated carbon cycle, similar to those found at Pomona. The experiences at Santee reinforced the Pomona data, showing that these problems were not unique.

COST OF THE CARBON ADSORPTION TREATMENT AT SANTEE

The total cost of activated carbon adsorption at Santee consisted of operations, carbon cost, and capital investments. These costs for the 100,000 gpd treatment plant have been enumerated in Table 6. Carbon man hours and dosage estimates were based on the disposal of the expended carbon. Regeneration of the carbon was not considered. As could be expected, the virgin carbon costs were high, requiring 37 percent of the total \$0.359 per 1000 gallons of product water. Operations required 36 percent and amortization, 27 percent of the total cost.

All amounts in Table 6 were based on actual numbers when available. The Operator II for the electrodialysis plant also maintained the activated carbon adsorption unit. Recording plant readings and monitoring the backwashing required an average 24 minutes per working day. The treatment plant at Santee was also monitored two times each 8 hour shift by the plant attendant on duty. Laboratory man hours were based on one technician spending 6 hours per week running COD's, turbidities, and color tests. Maintenance during the study period consisted of disassembly and assembly of the feed pump, backwash pump, and flow meters because foreign matter had lodged into the impellers or working mechanisms.

The departure from the original operational program has been discussed in the Approach To Study Section. The original 12,000 pounds of activated granular carbon loaded into the contactors was included in the virgin carbon cost in Table 6. It was then assumed that if the carbon in the lead contactor had not been regenerated, it would have been discarded and the vessel refilled with virgin carbon. This vessel would then have been placed in the tail position and the middle contactor advanced into the lead position. This arrangement would have remained through the rest of the study period. The virgin carbon loaded into the lead contactor would have made the total around 16,000 pounds. This is the amount used in the cost estimate.

TABLE 6 COST ESTIMATE FOR THE 100,000 GPD CARBON ADSORPTION PILOT PLANT OVER THE 18 MONTH STUDY PERIOD

Item	Amount	Unit Price	\$ Per 1000 Gallons
Operating Labor			
Operator II	8.75 hrs/mo	4.25/hr	0.0181
Operators III and IV	12 hrs/mo	3.50/hr	0.0204
Lab Technician	24 hrs/mo	4.25/hr	0.0495
Maintenance Labor			
Operator or Mech II	14 hrs/18 mo	4.25/hr	0.0016
Operators or Mech II & IV	16 hrs/18 mo	3.50/hr	0.0015
Overhead		40%	0.0364
Electricity			
Pumps	346kWh/mo	0.009/kWh	0.0015
Lights (12 hrs/day)	60 kWh/mo	0.009/kWh	0.0003
Total Operational Costs			0.1293
Virgin Carbon (original and replacement)	16,000 lbs/18 months	0.305/lb	0.1317
Amortization	\$71,487	20 yrs @ 6%	0.0972
Total Cost			0.3592

Construction costs given in Table 7 were taken from the October 1968 Contractor's Bid. The 1968 prices were adjusted to 1972 values by using the Los Angeles index of 133 for October 1968 and 176 for February 1972. This gave an updated construction cost of \$71,487.

It is felt that a feed pump alarm system would greatly reduce the evening and night shift man hours. This alarm would connect into the major control panel and would notify the attendant on duty of a feed pump failure or a loss of prime. These two occurrences were quite common throughout the study period. Problems with the loss of feed pump prime were almost eliminated when the inlet line was changed from a negative to a positive head. If the evening and night shift monitoring were reduced to a minimum, 182 hours could be subtracted from the Operator III and IV total study period man hours.

TABLE 7 CONSTRUCTION COST FOR CARBON ADSORPTION

Earthwork	\$ 200
Reinforced Concrete pad and walkways	300
Mechanical Piping underground feed and product lines, above ground connections between vessels	8,200
Mechanical Equipment feed and back wash pumps, vessels	17,300
Miscellaneous Iron frame for vessels, pipe supports, ladders and upper walkways	1,000
Painting	2,100
Electrical	273
Inspection (estimate)	1,795
Engineering (estimate)	3,106
Corrected Drawings	135
TOTAL CONSTRUCTION COSTS	\$34,409

Section VI

PART TWO: THE ELECTRODIALYSIS PILOT PLANT

DESCRIPTION OF THE ELECTRODIALYSIS PROCESS

Most salt and minerals are dissolved in water as positively charged particles called cations and negatively charged particles anions (all underlined words can be found in the glossary of terms). If two metal plates are placed in the water facing each other and a direct current (DC) potential is applied across the plates, one plate will become negatively charged (the cathode) and the other plate will become positively charged (the anode). The cathode will attract the cations in the solution, and the anode will attract the anions in the solution. By adjusting the current passed between the plates the rate the ions are transported can be varied.

To further control the movement of these ions, in between the two plates and in the stream of water are placed sheets of cation selective resins and anion selective resins. These resins are secured in a reinforcing synthetic web in order to give the sheet or membrane ample strength for industrial handling. When the DC potential is applied across the plates the positively charged particles such as sodium (Na^+) ions migrate towards the cathode and the negatively charged particles such as chloride (Cl^-) ions move towards the anode. The sodium will then pass through the cation selective membrane (C) but will not permeate the anion selective membrane (A). On the other hand, the chloride will pass through the anion selective membrane but will not penetrate the cation selective membrane. This phenomenon is depicted in Figure 13. The cations and anions will then collect on one side of each membrane and vacate the other. The collecting side is called the concentrating or the brine stream and the vacating side is called the diluting or product stream. Electrodialysis units are built on the concept of alternating these concentrating and diluting compartments (also Figure 13).

Polorization

As the ions move from the diluting stream and pass through the membrane, concentration polarization develops at the interface of the bulk solution and the membrane surface. These areas of polarization or polar layers may differ from the bulk solution in both concentration and composition, and generally adversely affect the electrodialysis process. Polarization occurs because the movement of the ions through the membranes is greater than the movement of ions through the bulk solution. Because of this, the bulk solution near the diluting stream compartment interfaces cannot replenish the ions at the rate they leave the stream and pass through membrane. The opposite condition occurs on the concentrating side of the membrane. Here, the ions which have passed through the membrane cannot sufficiently disperse into the bulk solution. Two distinct polarization layers develop on either

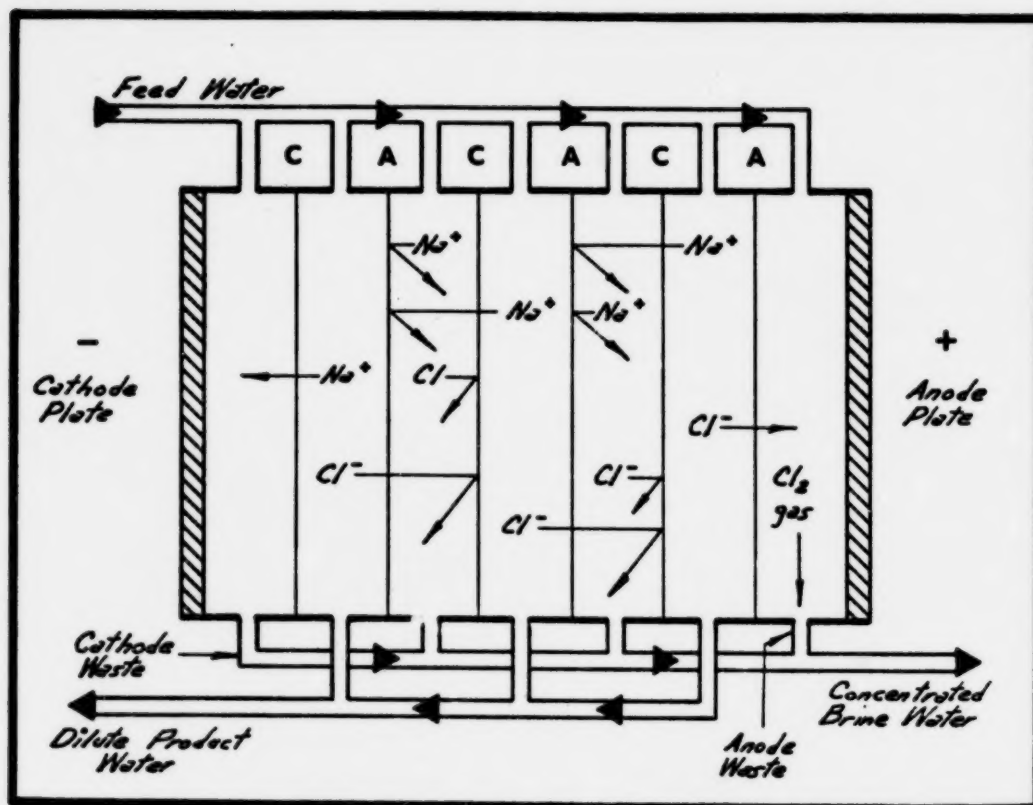


Figure 13. Diagram of the Electrodialysis Process

side of the membrane: on the diluting side, the polarization layer is less concentrated than the bulk solution, and on the concentrating side the polarization layer is more concentrated than the bulk solution. In a simple model, convection and diffusion are the only means by which ions are supplied to the diluting compartment polarization layer and dispersed from the concentrating compartment polarization layer. In practical operation, both streams are either stirred or agitated in order to minimize the thickness of these layers.

As the applied current or current density (applied milliamperage divided by the effective membrane area- mA/cm^2) is increased, the polarization layer in the diluting stream compartment decreases in concentration, and approaches zero. In theory, zero concentration is reached in the polarization layers at the critical current density. Slightly below and above the critical current density, the concentration of the normally migrating ions in the polarization layers become insufficient to pass the total current through the membrane. In order to maintain the applied current, water is dissociated. Hydroxyl ions pass through

the anion selective membrane and hydrogen ions pass through the cation selective membrane in competition with the deleting normally migrating ions. During practical operation, hydroxyl ions are transported at a greater rate than hydrogen ions. As the critical current density is approached and surpassed, the concentrating stream pH rises as it receives hydroxyl ions in greater number than hydrogen ions. The opposite occurs in the diluting stream, where the pH falls as more hydrogen ions are left behind.

Because of polarization during normal unit operation, four important conditions arise:

1. Increased ohmic resistance as the concentration of the layers in the diluting stream compartment is reduced.
2. As polarization reaches an extreme, water is dissociated. Since this dissociation does not contribute to desalting, the current efficiency, which is the ratio of equivalents of salt removed to the faradays of electricity passed, is reduced.
3. The concentration of the polarization layer in the concentrating stream compartment rises above that of the bulk solution. The level of concentration may exceed the solubility products of easily precipitated compounds such as magnesium hydroxide and calcium carbonate.
4. The amount of hydroxyl ions transported through the membranes is greater than the amount of hydrogen ions. This increases the possibility of the above compounds precipitating on the surface of the anion membrane in the concentrating stream compartment.

Current Density

The build up of concentration in the concentrating stream polarization layers, along with the presence of hydroxyl ions limits practical electrodialysis operation. pH changes near the membrane, accompanied by the precipitation of alkaline earth metal carbonates and hydroxides occur before there is any noticeable change in the effective current efficiency. With this in mind, the critical or limiting current density becomes a useful indicator of the onset of precipitation on the concentrating stream compartment surfaces. This parameter is important when establishing criteria for practical electrodialysis operations. Economically, current densities well above the critical current density are desirable, however, practically, operational current densities must remain near 80% of this critical value.

Current Efficiency

Current efficiency as stated before, is the ratio of equivalents of salt removed to the faradays of electricity passed. It is a good

measure of the degree of ion selectivity shown by the electrodialysis unit. Some conditions adversely affecting the current efficiency include water transfer by osmosis, back diffusion from the concentrating to the diluting stream, and under extreme conditions, polarization. Current efficiency also decreases with increasing diluting stream concentration, diluting stream pH, and concentrating-diluting stream ratios.

The calculated current efficiency for normal stack operations is based on the performance relative to the applied current. It is independent of the stack membrane area, method of operation, voltage, and resistance. Current efficiency is calculated as follows:

$$CE = \frac{\text{number of equivalents}}{\text{number of faradays passed} \times \text{number of cell pairs}}$$

$$CE = \frac{F(N_{in} - N_{out})Q}{(I) (cp)}$$

Where:

- F = The faraday constant (coulomb/equivalent)
- N_{in} = diluting stream influent Normality, ev/l
- N_{out} = diluting stream effluent Normality, ev/l
- I = applied current, amps
- cp = number of cell pairs
- Q = diluting stream flow rate, l/sec

Specific Ion Removal

Ions are not removed from the diluting stream equally. The amount removed of a specific ion depends mainly on the bulk solution composition and the properties of the membrane used. During normal operation, both these effects may fluctuate daily or even change permanently. The solution may change in pH, composition, and temperature. The membrane may develop scaling, and organic build ups on its surfaces, both of which increase the polarization layer thickness. The separation factor is used to indicate a specific ion removal. The removal of each ion is compared to the milliequivalents removed:

$$\text{separation factor} = \frac{\text{fraction of specific ion removed}}{\text{fraction of total mev/l removed}}$$

Inorganic Membrane Scaling

In waste water electrodialysis demineralization, inorganic scaling and organic buildups are two common problems which are encountered during normal operations. Inorganic scaling is brought about by polarization, and generally occurs in the concentrating stream compartment on the surface of the anion membrane. As previously discussed, this is where

pH sensitive compounds with low solubility products are present in an alkaline environment. Inorganic scaling usually results in permanent damage to the membrane.

Organic Membrane Fouling

Even after activated carbon pretreatment, a certain amount of colloidal and soluble organic matter remains in the feed water. Since these substances are negatively charged, they are attracted to the anode when the DC potential is applied. The organic matter then collects on the diluting side of the anion membrane. Generally, organic fouling is temporary and can easily be cleaned off the membrane surfaces. However, molecules in the lower size range can penetrate and bond with the membrane, taking up the available exchange sites. This causes permanent damage to the membrane. This type of permanent fouling usually occurs slowly and is accompanied by a gradual lowering of the critical current density.

Membrane Resistance

A quick and easy method used as the first indicator of membrane scaling or fouling is the applied current. If the DC voltage is kept constant, the current will decrease as the stack ohmic resistance increases. Although this value includes the stream resistances, it is accurate enough for use in daily operations and as criteria for unit flushing and membrane stack disassembly.

In interpreting the results, another form of membrane pair resistance is more useful (7). This resistance value eliminates the stream resistances and is defined by the equation:

$$R = \left(\frac{V}{NI}\right)A - t(\bar{P}_d + \bar{P}_c)$$

Where:

- V = The applied voltage in volts
- N = The number of cell pairs
- I = The applied current in amps
- A = The effective membrane area in cm²
- t = The spacer thickness in cm
- $\bar{P}_d$ = The diluting stream log mean specific resistance in ohm-cm
- $\bar{P}_c$ = The concentrating stream log mean specific resistance in ohm-cm

The equation is the sum of the mean stream resistances subtracted from the areal resistance. The calculated resistance value includes the resistance of both the anion and the cation membranes, the resistance due to scaling, organic fouling, polarization, and the electrodes.

Two assumptions are made when using the log mean resistance as the average stream resistance. First, the efficiency of the ion removal or the current efficiency is constant all along the stream flow path, and second, the stream specific conductance (micromhos/cm) is directly proportional to the stream concentration (mev/l). The log mean for the specific conductance of a given stream is obtained by the following equation:

$$\text{Log mean} = \frac{C_{\text{out}} - C_{\text{in}}}{\ln (C_{\text{in}}/C_{\text{out}})}$$

C_{out} = The stream effluent specific conductance, micromhos/cm

C_{in} = The stream influent specific conductance, micromhos/cm

The specific resistance for the stream is the reciprocal of this log mean.

Correction Factors

The resistance factor is assumed to vary lineally with the diluting stream temperature and the mean specific conductance. Because of this, all values are corrected to an average diluting stream mean specific conductance and an average solution temperature in degrees centigrade. The general equation used for these corrections is:

$$R_c = R (1 - f(\bar{x} - x))$$

Where:

R = Uncorrected resistance

f = Fractional change in resistance per degree centigrade or micromhos/cm

$\bar{x}$ = Correction temperature or micromhos/cm

x = Temperature or mean diluting stream conductance at which the resistance value is taken

DISCRIPTION OF THE ELECTRODIALYSIS UNIT

The Membrane Stack

The membrane stack was an Ionics two-stage Mark III demineralizer which produced 45,000 U.S. gallons of demineralized water in twenty-four hours of operation.

Cathode and Anode. Each stage had its own cathode and anode. These electrodes supplied the direct current electrical power. They are shown in Figures 14 and 15. The anodes were made of Tirrelloy B, a Columbian current-carrying base plated with platinum. The cathodes were made of 316 acid resistant stainless steel.

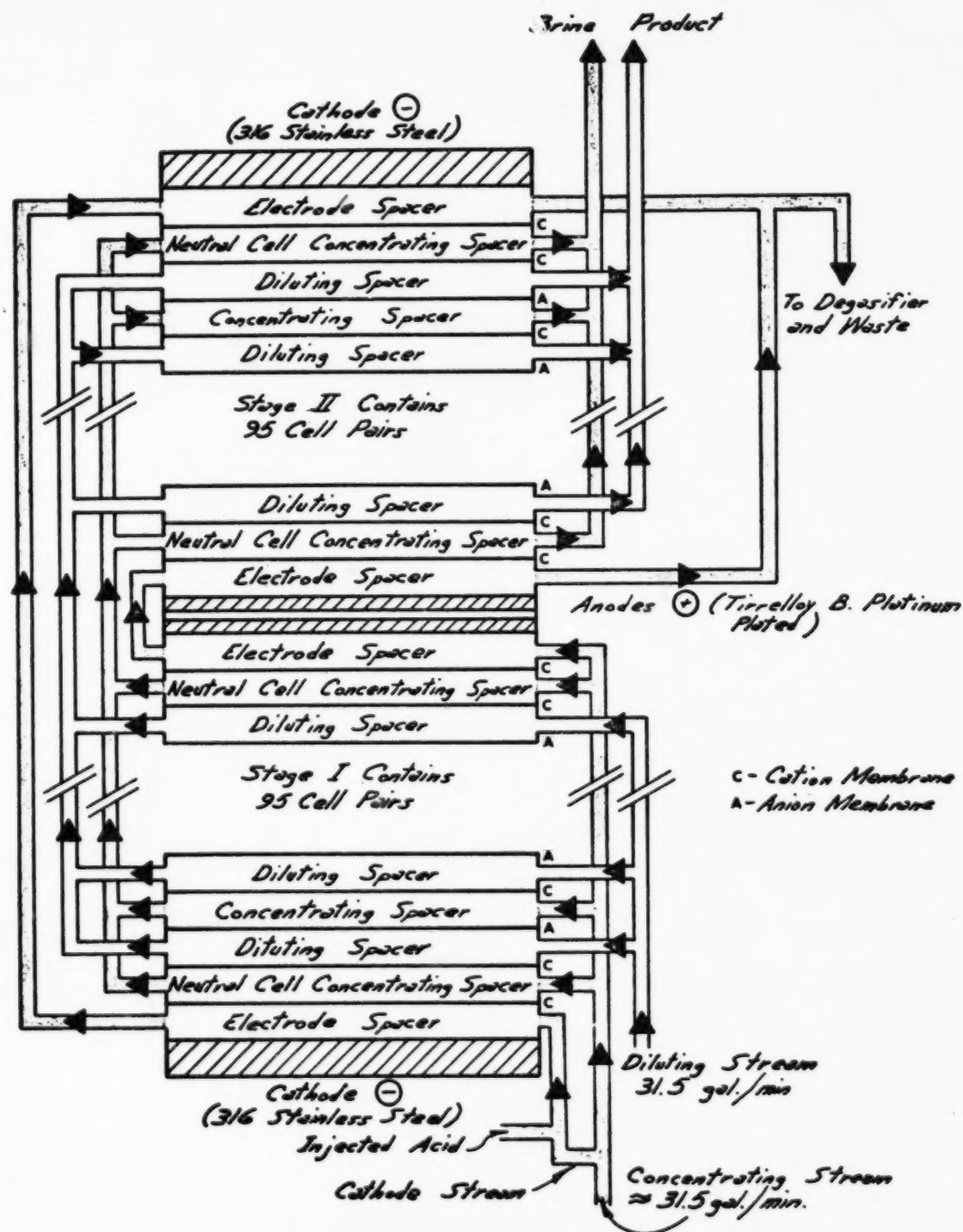


Fig. 14. Flow Pattern Through The Electrodialysis Stack, Showing The Two Stages In Series.

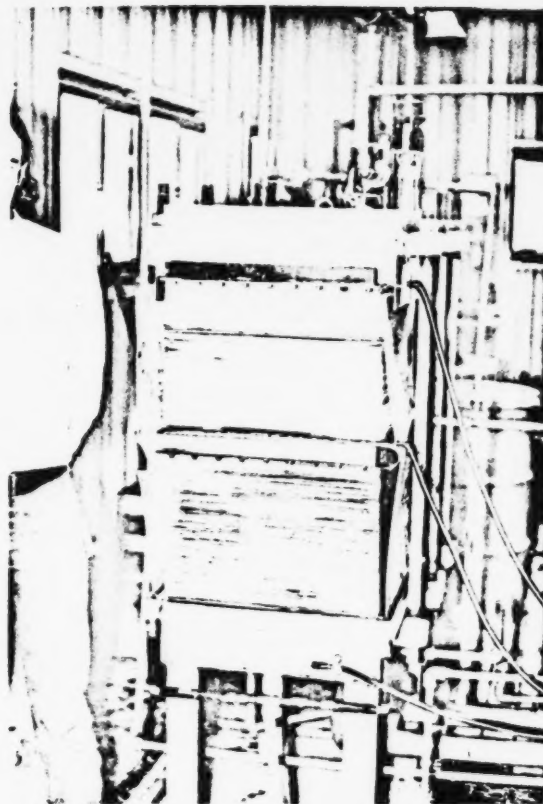


FIGURE 15 . PHOTOGRAPH OF THE
SIDE OF THE IDWICS MARK III
MEMBRANE STACK.

Cell Pairs. The center portion of each stage was composed of repeating membrane-spacer groups, or cell pairs. Each of the 95 cell pairs in the lower stage were arranged cation membrane-concentrate spacer-anion membrane-dilute spacer from top to bottom. The upper stage also had 95 cell pairs, but each arranged in the inverse order (Figure 14). The 190 cell pairs could receive a maximum 265 DC volts. The unit operated with 219 DC volts.

Membranes and Spacers. The flow of water between the membranes was more complex than was shown in Figure 13. Polyethylene spacers were placed between the alternating cation and anion membranes. These sheets had cut out areas in order to form flow paths. They were designed to use as much of the membrane area as possible ($2,960 \text{ cm}^2$) and kept the flow turbulent so that little of the stream was stagnant. The spacers also served as gaskets to confine each stream, and as frames to provide the optimum stream shape for demineralization.

The membranes and spacers like the ones used at Santee are shown in Figure 16. They measured 18 X 40 inches (45.7 X 101.6 cm) with the spacer 0.040 inches (0.102 cm) thick and the membrane 0.023 inches (0.058 cm) thick. The flow twisted back and forth across the membranes and over and under the straps placed across the flow pathway (1.00 cm wide). Figure 17 is a side view of the alternating membrane-spacer pattern. The drawing also illustrates how the straps extended approximately half-way into the pathway, purposely making the stream flow turbulent.

Diluting and Concentrating Stream Flows

A horizontal centrifugal pump rated at 39 U.S. gpm at 131 feet of head TDH, pumped water from the bottom of the storage tank to the electro-dialysis unit. This flow was filtered by a "Y" strainer. The flow pattern is shown in Figure 18. After the filters, the main stream at 37.5 gpm (2.37 l/sec) split into two branches. One branch continued at 31.5 gpm (1.99 l/sec) as the diluting stream. This flow was measured by an orifice assembly connected to a flow manometer. After the orifice, the flow passed through a diaphragm valve and entered the membrane stack.

The second branch of the feed water was taken off just beyond the multi-cartridge filters. The flow rate of this stream was maintained at 6 gpm (0.38 l/sec) and was measured by a rotometer. This water was supplied as make up for water earlier bled off the recirculating brine stream. The concentrating stream entered the stack parallel to the diluting stream at approximately the same flow rate of 31.5 gpm (1.99 l/sec). The flow rate and pressures of both streams were kept approximately equal in order to prevent membrane distortion. The flow went into the stack adjacent to the diluting stream, exited the first stream, and was internally redirected into the second stage. Soon after the brine stream left the stack, 6 gpm (0.38 l/sec) of it was bled off to waste, and approximately 25.5 gpm (1.61 l/sec) was recirculated and mixed with 6 gpm feed water as the concentrating stream influent.

Cathode Waste Stream

Water for the cathode plates was taken from the brine stream just before the membrane stack. This is shown in Figures 14 and 19. This stream flushed both hydrogen (H_2) gas and caustics from the cathode plate surfaces. If the caustics were not removed they would have led to scaling and permanent damage to the cathodes, adjoining membranes, and spacers. The cathode stream flushed the cathodes in series, left the membrane stack, and joined the anode stream. The flow rate of the combined cathode and anode streams was approximately 1.3 gpm (0.082 l/sec).



FIGURE 16. PHOTOGRAPH OF THE IONICS MARK III CATION MEMBRANE (LOWER) AND SPACER (UPPER).

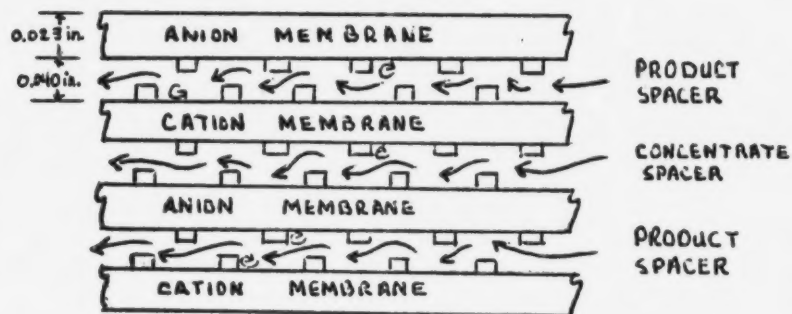


FIGURE 17. SIDEVIEW DIAGRAM OF THE ALTERNATING MEMBRANE - SPACER PATTERN. ALSO SHOWING FLOW AND TURBULENCE PROMOTER.

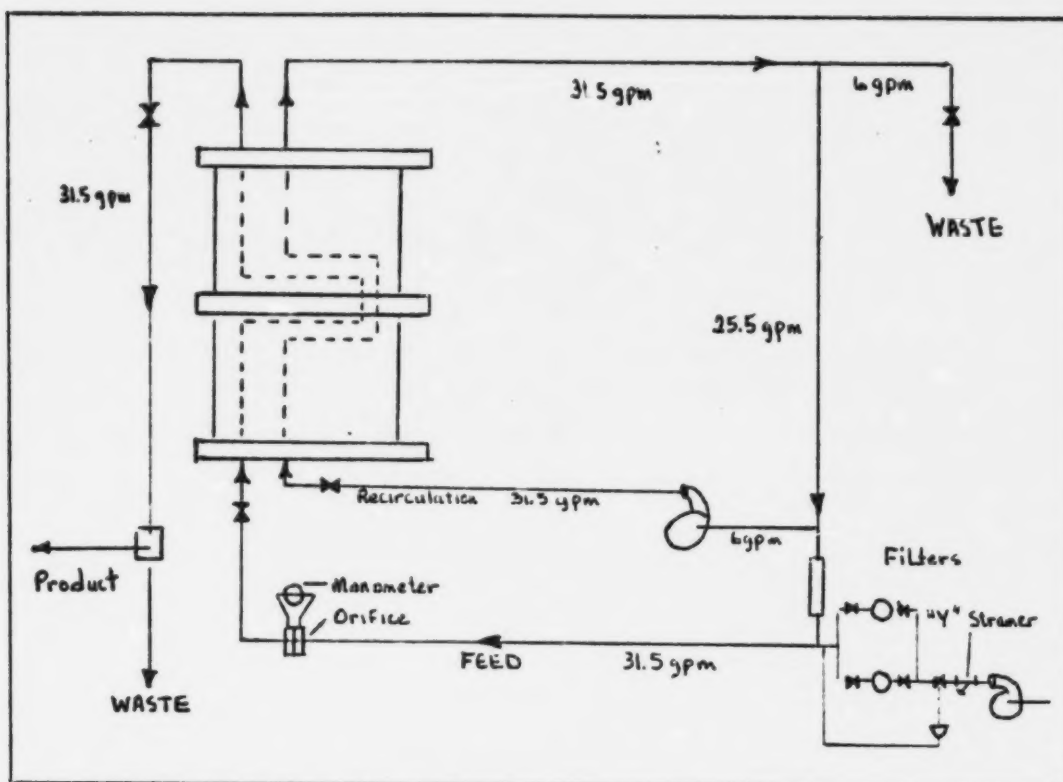


FIGURE 18. FEED AND RECIRCULATION FLOW SCHEME.

Anode Waste Stream

The anode plates were also flushed. The stream used for this purpose originated within the stack and was taken off the brine stream (Figures 14 and 19). Oxygen (O_2) and chlorine (Cl_2) gases formed at the anode plates were rinsed from the plates surfaces and mixed with the cathode effluent before the degasifier.

Injection Systems

Two streams of the unit needed pH control. Because of the high pH of the cathode stream, substances such as carbonates and hydroxides were likely to precipitate on the cathode surface and the adjacent membrane. This was prevented by injecting sulfuric acid into the stream and maintaining the stream at a pH of 2 or less. The recirculating-brine stream also required acid injection. This stream maintained a high concentration of salt which was near the solubility constant of some carbonates and sulfates. In order to keep this stream stable, the pH was maintained between 3 - 5.5. Sodium hexametaphosphate (SHMP) was also injected. The injection systems are illustrated in Figure 20.

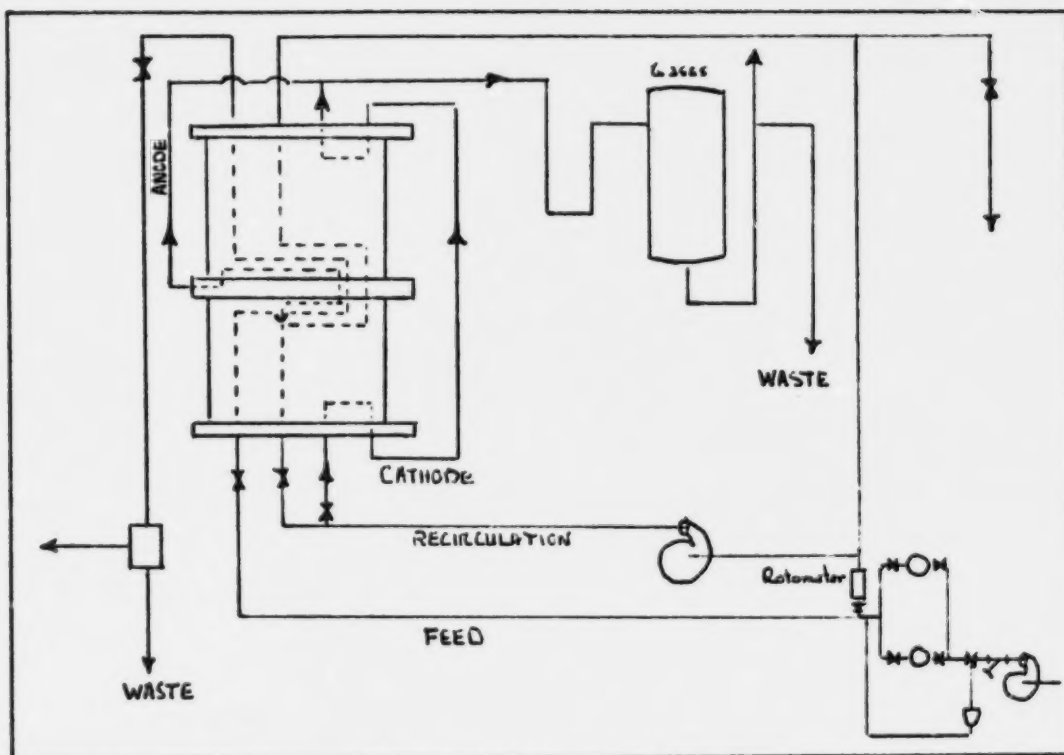


FIGURE 19. FLOW THROUGH THE MEMBRANE STACK.

Sulfuric acid was used because of its low cost and ease of handling. The bulk concentrated acid was stored in an 800 gallon steel tank kept outside electro dialysis building. The acid was transferred, using a small positive displacement pump, from the large outside tank to a smaller fifty gallon day tank. The acid was then drawn out of the fifty gallon tank using a PVC eductor and tap water. As the acid was pulled out, it is mixed to a 20% solution and stored in a 200 gallon fiberglass tank. Figure 20 diagrams the fifty gallon concentrated acid day tank and the dilute acid tank. The 20% acid in the dilute tank was injected into the recirculating brine and the cathode streams by a dual head, positive displacement diaphragm pump.

SHMP was mixed in two fifty gallon barrels and injected into the recirculating brine stream by a separate positive displacement diaphragm pump.

Pressure Alarms and Control System

As a protection against widely varying membrane stack inlet pressures, the unit was equipped with a pressure reducing valve. Figure 18 shows how the valve was set up to control the pressure below the multi-cartridge filters. This was done so that the stack inlet pressure was

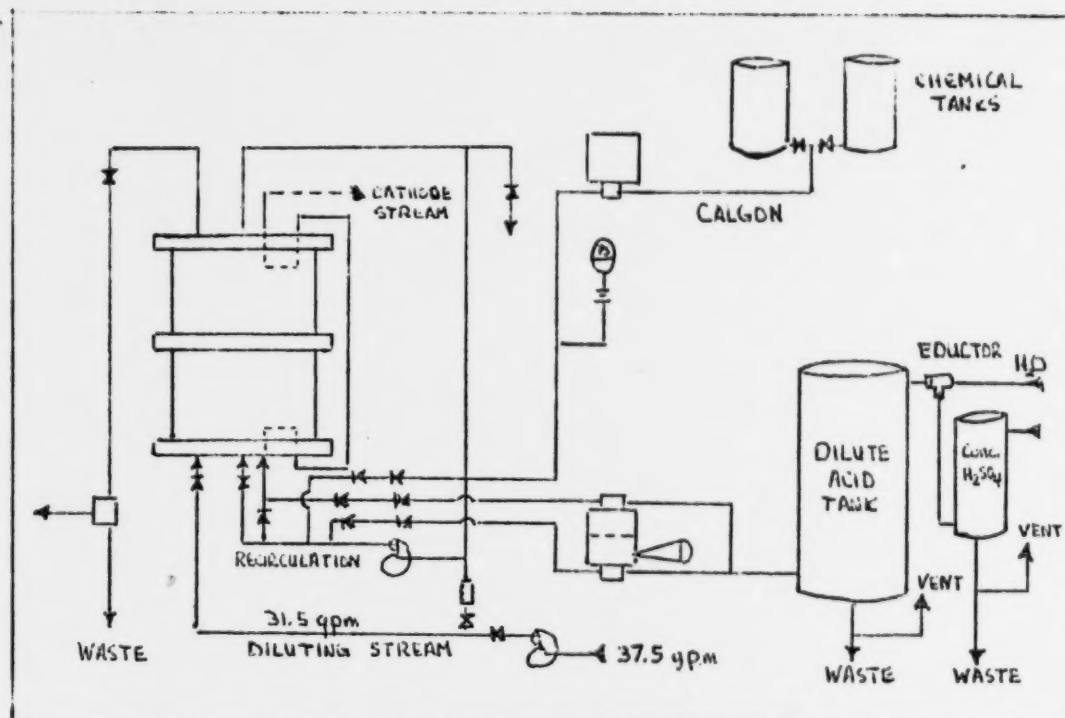


FIGURE 20. ACID AND SODIUM HEXAMETAPHOSPHATE INJECTION SYSTEMS.

kept constant as the feed pressure fluctuated and the filters clogged. Along with this control, a pressure protection system was included. Dual setting pressure switches located just before the stack were set up in both the diluting and concentrating streams. These pressure switches shut off the unit power if the psig varied more than 5 psi units above or below the normal operating pressure. The switches also activated a red light and a bell located on the instrument panel. A timer was installed in the alarm system to bypass the switches at start-up.

Operation Controls

As mentioned in the flow section, a motor operated valve controlled the direction of the diluting stream effluent. This valve was controlled by a conductivity meter located in the control panel. The desired conductivity of the product water could be set on this meter. If the actual diluting stream effluent conductivity rose above this set point, the motor operated valve was activated and redirected the stream to waste. Simultaneously, a red light on the control panel energized and an alarm horn sounded. A green light on the control panel indicated that the diluting stream conductivity was below the set point.

Along with the alarm systems, the instrument panels contained DC voltage meters and amp meters for each stage. A rheostat for the first stage and two tap switches for the second stage enabled stage voltage control over a wide range. Also housed in the panels were the recorders, converters, and transmitters for the pH control system.

The pH of both the cathode and the brine streams were continuously recorded on instruments in the control panel. pH measurement electrodes contained in sample chambers were located in each stream. Converters, mounted on the skid, relayed milliamper signals to the instrument panel. There, the milliamper signals were converted to pneumatic signals and sent to the recorder-controller. The pH's of both streams were then recorded. The air signals on the brine side were further relayed to a pneumatic operator located on one side of the dual head positive displacement diaphragm pump. The pneumatic operator controlled the amount of dilute sulfuric acid injected into the brine stream so that the pH was kept in the 3 - 5.5 range. The other head of the pump injected dilute sulfuric acid into the cathode stream and was set manually to keep the pH of the stream less than or equal to 2.

Grounding System

Metal grounding rods extended into both the brine and product streams as they entered and left the stack. The rods were also placed in the cathode and anode effluent, and in all the sample taps. They extended into the stream flow and grounded to the skid by braided cables. The streams were grounded because they maintained a small residual DC voltage. If not grounded, the small voltages were picked up as static by the pH electrodes.

pH and SHMP Alarms

Pressure switches were placed in the instrument panel to monitor the pH pneumatic signals. If the pH of either the brine or cathode stream was too high or low the rectifier would shut off. There was no direct alarm. However, soon after the rectifier shut off, the conductivity of the product water rose above the set point, and the alarm was energized. The extremities of the desired pH range could be manually adjusted.

The calgon injecting system also had a protection against pump failure or the lack of the calgon solution. A pressure switch was installed before the injecting stream entered the recirculating brine stream. If little or no pressure occurred, the switch shut off the rectifier. No direct alarms were in this system either.

Section VII

PLANT OPERATIONS AND METHODS

APPROACH TO OPERATIONS

The electrodialysis unit was operated as an integral part of the advanced waste treatment plant. The program was established for twenty-four hour operation, seven days a week. Shutdowns occurred only when unavoidable. Continuous operation was possible throughout the project period, except between 1st September 1970 and 1st January 1971, when operations were sporadic because of several major secondary and tertiary mechanical changes or problems.

OPERATIONAL DUTIES

The Ionics Operation and Maintenance Manual (11) was closely followed. As recommended, the electrodialysis plant was monitored by either the provided alarms, or visual inspection twenty-four hours a day. The operator kept a daily log provided by Ionics. Conductivities, pH's, water temperature, flow rates, and pressures were recorded two or three times during each working day. In addition, flow rates, pH's, and pressures were monitored during both the evening and night work shifts.

The Santee operator assigned to the electrodialysis plant was on evening and weekend call. The attendant at the secondary and tertiary plant would notify him of any immediate pilot plant problems. All minor maintenance was performed by the operator. However, most major repairs or maintenance were handled by the Santee regular day maintenance crew.

CHEMICAL PREPARATION

Sulfuric Acid

A closed system was used for preparing dilute sulfuric acid. When the tap water valve was turned on, the water flowed through an eductor, and enough concentrated sulfuric acid was drawn from the day tank for a 20% (by weight) solution in the dilute acid tank. A manometer on the day tank was used to verify the proportions of sulfuric acid to tap water after mixing.

Sodium Hexametaphosphate

Fifty pounds of powdered sodium hexametaphosphate (SHMP) were supplied when the pilot plant was initiated. The SHMP solution was prepared, by the operator, in the polyethylene lined 55 gallon steel drum. One pound of SHMP was mixed with one foot (20 gallons) of tap water in the drum. This proportion was established by Ionics and equaled 6,000 mg/l.

The solution was injected at one foot per operating day.

METHODS USED FOR REJUVENATION OF THE MEMBRANE PERFORMANCE

Sulfuric Acid Flushes

Sulfuric acid flushes were performed when needed. The criteria for acid flushes was based on first, current density, and second, on the stack diluting stream influent gauge pressure. When the influent gauge pressures were evaluated, the diluting-concentrating streams differential pressure was also considered.

Procedures for sulfuric acid flushes were as follows:

1. The applied current from the rectifier was shut off.
2. The manual valves were adjusted so that the "cathode" head of the acid pump injected acid into the diluting stream, just before the membrane stack. The set up is illustrated in Figure 21.
3. The diluting stream flow rate was then adjusted until the membrane stack effluent fell into the two to three pH range. The effluent was directed to waste.
4. The low pH water was passed through the stack for one hour.
5. One of two procedures was then followed:
 - a. Either the acid pump was shut off and the membrane stack flushed for one hour with carbon adsorption effluent,
 - b. or, the unit was completely shutdown for forty-five to sixty minutes with the low pH water in the stack, and then flushed with carbon adsorption effluent for fifteen minutes without the applied stack current.

Enzymatic Detergent Flushes

Enzymatic detergent flushes were performed when the influent gauge pressures and the diluting-concentrating streams pressure differential indicated flow resistance or fouling. They were sometimes performed alone or directly following a sulfuric acid flush.

The enzymatic detergent solution was recirculated. This was done in order to maintain the solution temperature at 96° Fahrenheit (36°C) and to conserve the costly detergent. The procedure was as follows:

1. The applied stack current from the rectifier was shut off.
2. The waste line was closed up with a manual valve, and the diluting stream effluent was redirected back to the recirculation tank. This is illustrated in Figure 22.
3. The recirculation tank was then installed into the feed line.
4. The 20g/l enzymatic detergent-tap water solution at 96°F (36°C) was recirculated through the diluting stream compart-

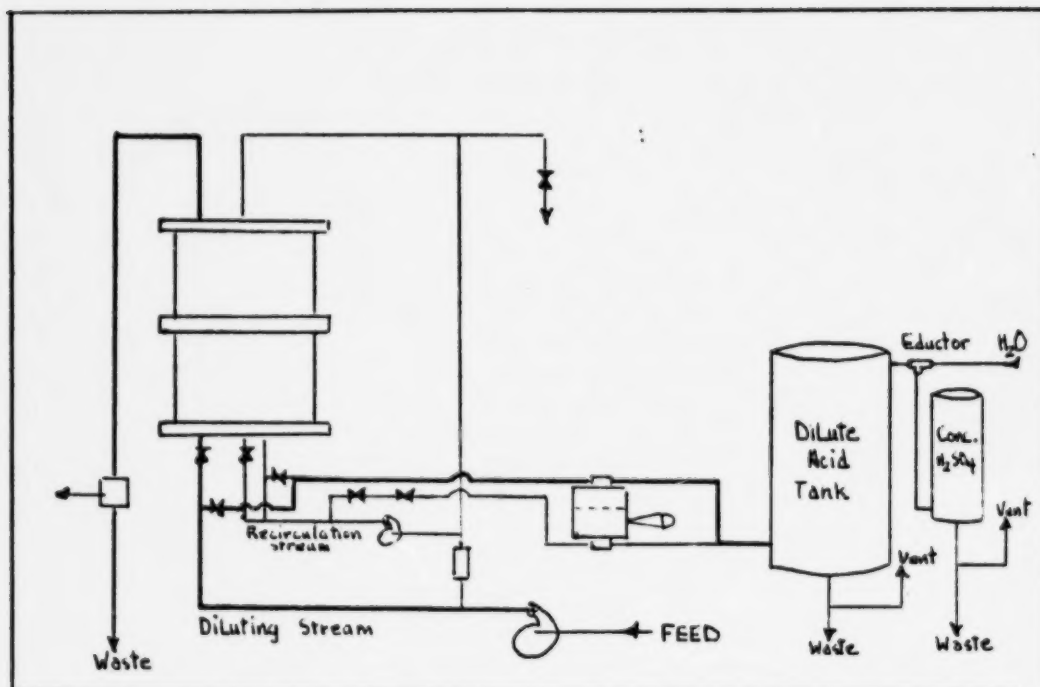


FIGURE 2L SET UP FOR ACID FLUSH OF THE DILUTING STREAM

- ment for one to two hours. The solution pH was near 9.
5. The unit was completely shutdown for one to two hours, and then flushed with tap water (96°F) for fifteen minutes.

Current or Stack Shutdowns

Current shutdowns were performed when the current density or the influent pressures and stream pressure differentials indicated minor membrane or flow resistance.

The procedure was as follows:

1. The applied current from the rectifier was shut off.
2. The hydraulic flows were maintained through the stack from thirty minutes to three days.

Complete or Hydraulic Shutdowns

Hydraulic shutdowns were performed when the stack shutdowns had little or no effect on unit performance, or when the current density was rapidly decreasing. The procedure was a complete plant shutdown for thirty minutes to one day.

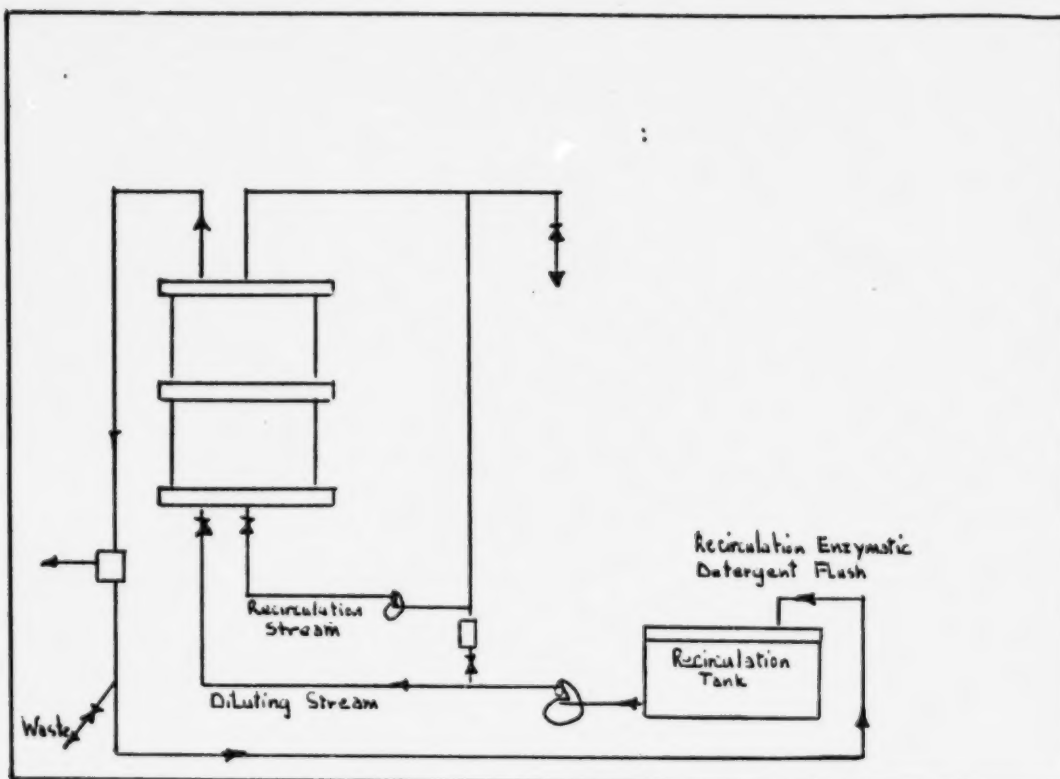


FIGURE 22. SET UP FOR RECIRCULATING ENZYMATIC DETERGENT FLUSH OF THE DILUTING STREAM

Air Scrub

Air scrubs were executed when the diluting stream influent gauge pressure and the diluting-concentrating streams pressure differential were extremely high. Air from the electrodialysis air compressor was injected into either the concentrating or diluting stream. The equipment set up is presented in Figure 23. The air was injected at 30 to 35 gauge psi, just above the operating pressures of 21 to 24 gauge psi.

The procedure for air scrub was:

1. The applied current from the rectifier was shut off.
2. The unit was operated at normal hydraulic flow rates and pressures.
3. Air was injected into either the concentrating or diluting stream at 30 to 35 gauge psi.
4. The injection was continued from 30 to 60 minutes, or until the effluent stream was free of foreign matter.

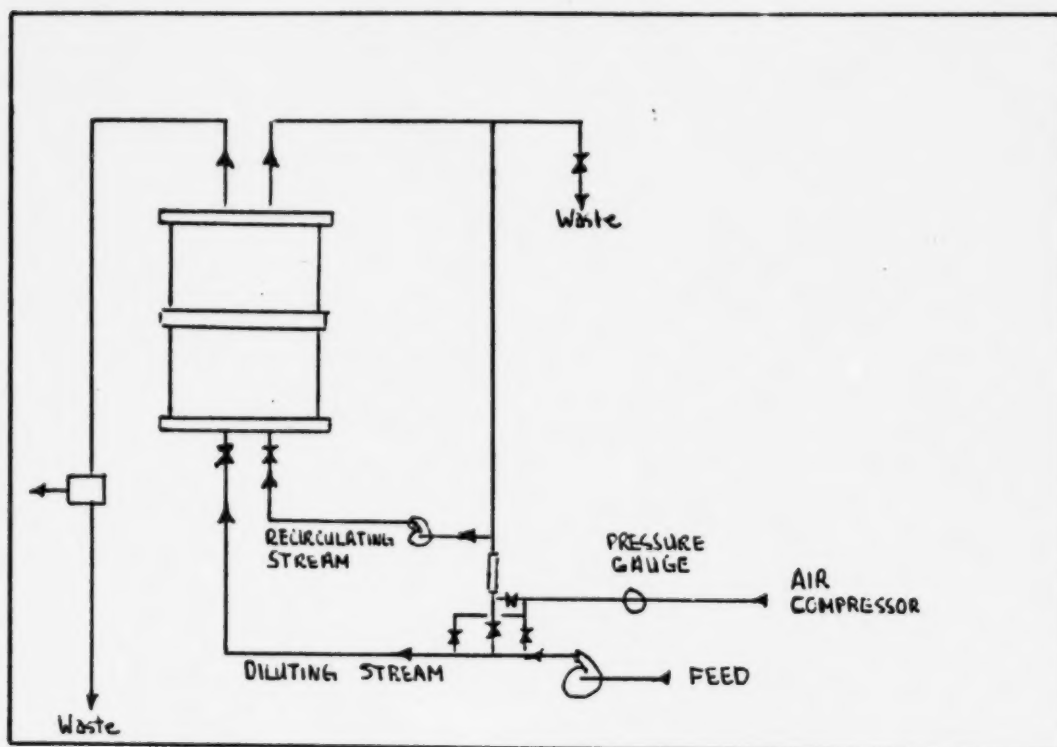


FIGURE 23. SET UP FOR AIR SCRUB

MEMBRANE STACK SERVICE AND MAINTENANCE

Voltage Probes

Voltage probes were used to locate isolated fouling and scaling within the membrane stack. This method was recommended by Ionics and was included in the Operational Maintenance Manual. A voltmeter was used to measure the electrical potential between distances along the sides of the assembled membrane stack. If any interval potentials were abnormally high, the area was marked and closely inspected when the stack was disassembled.

Stack Disassembly and Assembly

Stack disassembly and assembly were necessary in order to handclean the membranes. Handcleanings were performed when the overall stack performance was poor, or when the voltage probes revealed an area of high resistance, or, later in the project, when the membrane rejuvenation methods failed to restore the stack performance. Disassembly and assembly procedures were taken from the Ionics Operational and Main-

tenance Manual.

Cleaning the Membrane

The usual procedure for removing the slime and light surface films from the membrane was to rub the surface with the palm of the hand while spraying it with a strong jet of tap water. Occasionally, a soft fiber brush was also used.

When scaling occurred, it was usually too severe to be cleaned off and the membrane was replaced.

The slime or organic buildup on the spacers was cleaned off with a strong jet of tap water while rubbing it with a soft fiber brush.

SAMPLING

Samples for laboratory analyses were taken twice weekly. They were composites of twenty-four hourly 400 milliliter aliquots. These aliquots were automatically drawn directly from the stream by timer controlled sampling pumps, and collected in 2.5 gallon (9.46 l) bottles. These bottles were kept at 40°F (4.4°C) in refrigerators.

Sampling points are diagramed in Figure 24. Station number 1 was carbon adsorption influent. Station number 2 was first carbon adsorption column effluent. Station number 3 was carbon adsorption unit effluent. In January, 1970 this station was relocated after the storage tank. Station number 4 sampled the electrodialysis diluting stream effluent.

In the Spring of 1971, five twenty-four composite samples were taken of the electrodialysis diluting stream influent, first stage effluent, second stage effluent, and the concentrating stream effluent. These composites were made up of hourly 500 milliliter aliquots which were hand taken by the Santee attendant on duty.

All samples for pH's and specific conductances used to monitor the unit were grab samples.

LABORATORY

The laboratory staff performed ion analysis on composite samples 1 through 4 (Figure 24), twice weekly. The minimum testing schedule is shown in Table 8. Occasionally during the project, the concentrating stream was analyzed. When performed, this analysis was identical to that of the electrodialysis effluent.

Methods for individual analyses are presented in Table 9. At the onset of the project, a Spec 20 was used for photometric determinations. This unit was replaced with a Beckman DK-2 Spectrophotometer in December, 1970. Potassium and sodium analysis were performed with a Perk and Elmer Atomic Absorption unit, model 290B. Nitrate concentrations were

TABLE 8 TYPICAL TUESDAY AND THURSDAY ANALYSIS PERFORMED BY THE
SANTEE LABORATORY STAFF

Test - mg/l	Pre-carbon	Carbon Effluent	Electrodialysis Effluent
Total Dissolved Solids - TDS	X	X	X
Total Phosphate - P	X		
Ortho Phosphate - P	X		X
Total COD	X	X	X
BOD		X	X
Nitrate - N	X		X
Nitrite - N	X		X
Total Kjeldahl as N	X		X
Ammonium - N	X		X
Turbidity - J.T.U.	X	X	X
Color - units	X	X	X
Calcium - Ca	X		X
Magnesium - Mg		X	X
Potassium - K		X	X
Sodium - Na		X	X
Alkalinity - CaCO ₃			X
Total Hardness - as CaCO ₃	X	X	X
Chloride - Cl		X	X
Sulfate - SO ₄		X	X
pH - units	X	X	X
Total Suspended Solids	X		
Temperature - °C		X	X
Iron - Fe		X	X

TABLE 9 METHODS AND SOURCE OF CHEMICAL TESTS PERFORMED BY THE SANTEE LABORATORY

Test mg/l	Method	Alternate Method	Source
Total Dissolved Solids	Filtrable Residue	----	Standard Methods (SM)
Ortho Phosphate	Stannous Chloride		SM
Total Phosphate	Stannous Chloride	Persulfate	SM
Total COD	K ₂ Cr ₂ O ₇ Reflux 0.025N		FWPCA Manual
BOD	5 Day		SM
Nitrate	Specific Ion Meter	Brucine Sulfate	SM
Nitrite	Diazotization		SM
Total Kjeldahl	Digestion		SM
Ammonia	Distillation		FWPCA Manual
Turbidity (J.T.U.)	Turbidity Meter		FWPCA Manual
Color (C.U.)	Nessler Tubes		SM
Calcium	EDTA Titration	Atomic Absorption	SM
Magnesium	EDTA Titration	Atomic Absorption	SM
Potassium	Atomic Absorption		SM
Sodium	Atomic Absorption		SM
Alkalinity	Potentiometric		SM
Total Hardness	EDTA Titration		SM
Chloride	Mohr		SM
Sulfate	Turbidimetric		SM
pH	Glass Electrodes		SM
Suspended Solids	Nonfiltrable Residue		SM
Temp °C	Thermometer (Hg)		SM
Iron	Phenanthroline		SM
Conductance	Wheatstone Bridge		SM
Silica	Molybdate		SM

SECTION VIII

RESULTS

OPERATIONAL PERIODS

There were three operational periods. The first period extended from the start-up in March, 1970 until 28 August 1970, Day 240. No fouling or scaling prevention methods were used in this time. The second period was from 28 August 1970, day 240 until 12 January 1971, day 12. The pilot plants were shutdown 89 days in this 110 day period because of tertiary reconstruction. The third period was from 12 January 1971, day 12, until 25 June 1971, day 176. All available membrane rejuvenation methods, which circumvented stack disassembly, were used during this time.

In the first period the electrodialysis membrane stack was disassembled and handcleaned when the DC amperage fell below or the influent pressure rose above the Ionics recommended values (Table E-1, Appendix E). The schedule of handcleanings and apparent reason for run termination were recorded in Table 10. During this period, the stack was handcleaned eight times averaging eighteen days between handcleaning. Table 11 gives the days of actual demineralizer operation for each run.

During the second period, operation of the pilot plant was intermittent. The reactor-clarifier was drained and tertiary shutdown for pipe relocations. After the reactor-clarifier was restarted, further changes and repairs were made on the carbonation unit. Twenty-one days of operation were accumulated in this time period. A more detailed account of shutdown time is in Table B-6 of Appendix B.

In the period from 12 January 1970, day 12 until 25 June 1971, day 176, all efforts were made to retard membrane fouling and scaling without a stack disassembly. Sulfuric acid flushes, enzymatic detergent flushes, and shutdowns were used to maintain the stack DC amperage and the influent pressure at the Ionics recommended values. Using these methods, the demineralizer operated for 138 days before handcleaning the membrane stack was necessary.

APPENDICES

The appendices are divided into five parts. Appendice A contains tabulated data tables. Appendix B contains the daily electrodialysis logs. Appendix C contains the daily carbon adsorption logs and Appendix D, the chemical analysis data. Miscellaneous data are gathered in Appendix E.

Appendix A, Tabulated Data Tables

The first table of this appendix is the sums of the dependent and independent variables for the least squares equations. These equations establish the relationship between the solution normality and the

TABLE 10 SCHEDULE OF HANDCLEANING AND APPARENT REASONS FOR RUN TERMINATIONS

Length of Run Day of Year	Date of Handcleaning	Avg. Inf't COD mg/l	Apparent Reason for Run Termination and Handcleaning
First Period. No Fouling Prevention Methods Used.			
71 - 126 3/12 - 5/6	6 May 1970	5.87	Stack fouled. 1st stage amperage gradually decreased.
126 - 142 5/6 - 5/22	22 May 1970	9.07	Stack fouled. 1st stage amperage rapidly decreased.
142 - 162 5/22 - 6/11	11 June 1970	11.3	Stack fouled. Low 1st stage amperage.
162 - 175 6/11 - 6/24	24 June 1970	21.6	High COD's. Hot spots at cathodes. Replaced two scaled membranes.
175 - 189 6/24 - 7/8	8 July 1970	19.1	High COD's. 1st stage amperage low.
189 - 195 7/8 - 7/14	14 July 1970	10.6	Stack fouled. 1st stage amperage low.
195 - 209 7/14 - 7/28	28 July 1970	14.4	Residual algae from upstream cleaning fouled stack.
209 - 216 7/28 - 8/4	4 Aug 1970	18.7	System still fouled with algae. Inf't pressures high.
216 - 240 8/4 - 8/28	----	14.0	Unit running good. Tertiary reconstruction began 8/28.
Second Period. Tertiary Reconstruction and Changes.			
240 - 316 8/28 - 11/12	12 Nov 1970	16.8	Stack fouled. Tertiary still not under routine operation
316 - 350 11/12 - 12/16	16 Dec 1970	12.5	Inf't quality varied. Recarbonation unit repairs and changes.
Third Period. Fouling Prevention Methods Used.			
350 - 12 12/16 - 1/12	1 Jan 1971	19.4	Stack inspected but not hand cleaned.
12 - 176 1/12 - 6/25	25 June 1971	14.8	Acid and Biz flushes used regularly. Tracks of spacers fouled. Inf't pressures high.

TABLE 11 DAYS OF ACTUAL ELECTRODIALYSIS UNIT OPERATION IN TIME PERIODS AND APPARENT REASONS FOR SHUT DOWNS

Day of Year	Days of Operation	Days in Time Period	General Reasons for Shut Downs
First Period. No Fouling Prevention Methods Used.			
71 - 126 3/12 - 5/6	23	55	Tertiary system down 32 days for repairs.
126 - 142 5/6 - 5/22	16	16	-----
142 - 162 5/22 - 6/11	17	20	Down 2 days (weekend) after handcleaning. Current shut down - 1 day.
162 - 175 6/11 - 6/24	13	13	-----
175 - 189 6/24 - 7/8	13	14	Down 1 day. Potable water used for tertiary system cooling water down.
189 - 195 7/8 - 7/14	6	6	-----
195 - 209 7/14 - 7/28	14	14	-----
209 - 216 7/28 - 8/4	7	7	-----
216 - 240 8/4 - 8/28	21	24	Unit down 3 days for pH monitoring system repairs.
Second Period. Tertiary Reconstruction and Changes.			
240 - 316 8/28 - 11/12	18	76	Down for tertiary reconstruction and acid injection and monitoring problems.
316 - 350 11/12 - 12/16	3	34	Down for recarbonation unit repairs and changes. Also acid pump repairs.

TABLE 11 DAYS OF ACTUAL ELECTRODIALYSIS UNIT OPERATION IN TIME PERIODS AND APPARENT REASONS FOR SHUT DOWNS (CONTINUED)

Day of Year	Days of Operation	Days in Time Period	General Reasons for Shut Downs
Third Period. Fouling Prevention Methods Used.			
350 - 12 12/16 - 1/12	22	26	Unit down because of acid pump repairs.
12 - 176 1/12 - 6/25	138	164	Down 14 days for acid pump repairs. Down 7 days for tertiary problems. Down 5 days for pH monitoring system.

solution specific conductance. All data points for the calculations of these equations were taken from the chemical analysis tables and Appendix D.

The second group of data in Appendix A, Table A-2, is the mean resistance of the diluting and concentrating streams. The mean resistance is the reciprocal of the logarithmic mean conductance discussed in the theory section. Stream conductances used for the log mean calculations were taken from the influent and effluent conductance and pH table in Appendix B.

The calculated membrane resistance values are given in Table A-3. The membrane resistances were calculated from the equation presented in the theory section. Solution mean resistances used in this equation were taken from Table A-2. Other variables used in the equation were taken from the electrodialysis demineralizer DC voltage and DC amperage table in Appendix B.

Calculated resistance values were corrected to 1,425 micromhos/cm influent conductances, and 21.7 degrees centigrade water temperature. These values are also in Table A-2.

Appendix B, Electrodialysis Demineralizer Logs

Tables B-1 and B-2 of this Appendix include records of pressures, flows, water temperatures, conductances, DC voltages, and DC amperages. Table B-3 gives the conductances and pH's of grab samples taken from each stream. These tests were performed in the Santee Laboratory by the pilot plant operator.

Table B-4 of Appendix B is the record of the sulphuric acid and sodium hexametaphosphate levels and additions. The acid, chemical,

recirculation, and feed pump hour meter readings are gathered in Table B-5. Included in this table are the watt meter readings which represent the kilowatt-hours of electricity consumed by the rectifier.

Table B-6 is a monthly operational log for the electrodialysis pilot plant. A record of the shutdowns and their apparent reasons are included.

Appendix C, Carbon Adsorption Logs

This appendix includes all hour meter readings, flows and pressures for the carbon feed and backwash pumps. The pressure differential across the lead carbon contactor is also included.

Appendix D, Chemical Analysis

There are four tables in this appendix. Each table is data for a sample location as discussed previously in the sample section. The chemical analysis are of the twice weekly composite samples performed by the Santee laboratory staff.

Table D-1 is the chemical data for the carbon adsorption influent. Table D-2 is data for the first carbon adsorption contactor effluent. Table D-3 is data for the electrodialysis influent or carbon adsorption effluent, and Table D-4, data for the electrodialysis effluent.

Appendix E, Miscellaneous Tables

The first table, E-1, of this appendix contains the recommended operational parameters values which were established by the Ionics engineers. Table E-2, the second table, is the chemical analysis data from the tests performed by the Advanced Waste Treatment Research Laboratory of R.A. Taft Water Research Center in Cincinnati, Ohio. These tables include a drinking water analysis of the electrodialysis effluent, and analysis of membrane deposits. Table E-3, the last table, contains DC voltage and DC amperage data collected during the polarization tests.

STACK DC AMPERAGE

Stack DC amperage, along with ohm's law, was the first measure of membrane resistance. If the stack DC voltage was held constant at the Ionics recommended values, each stage applied DC amperage would decrease as the membrane resistance increased. Membrane resistance would rise as the organic and inorganic deposits collected and as polarization developed.

The salient DC amperage for each stage during the latter part of the first period is shown in Figure 25. As the membranes fouled, the DC amperage decreased. The first stage amperage displayed a high of 20 amps after the handcleaning on day 162, and a low of 13.8 amps after

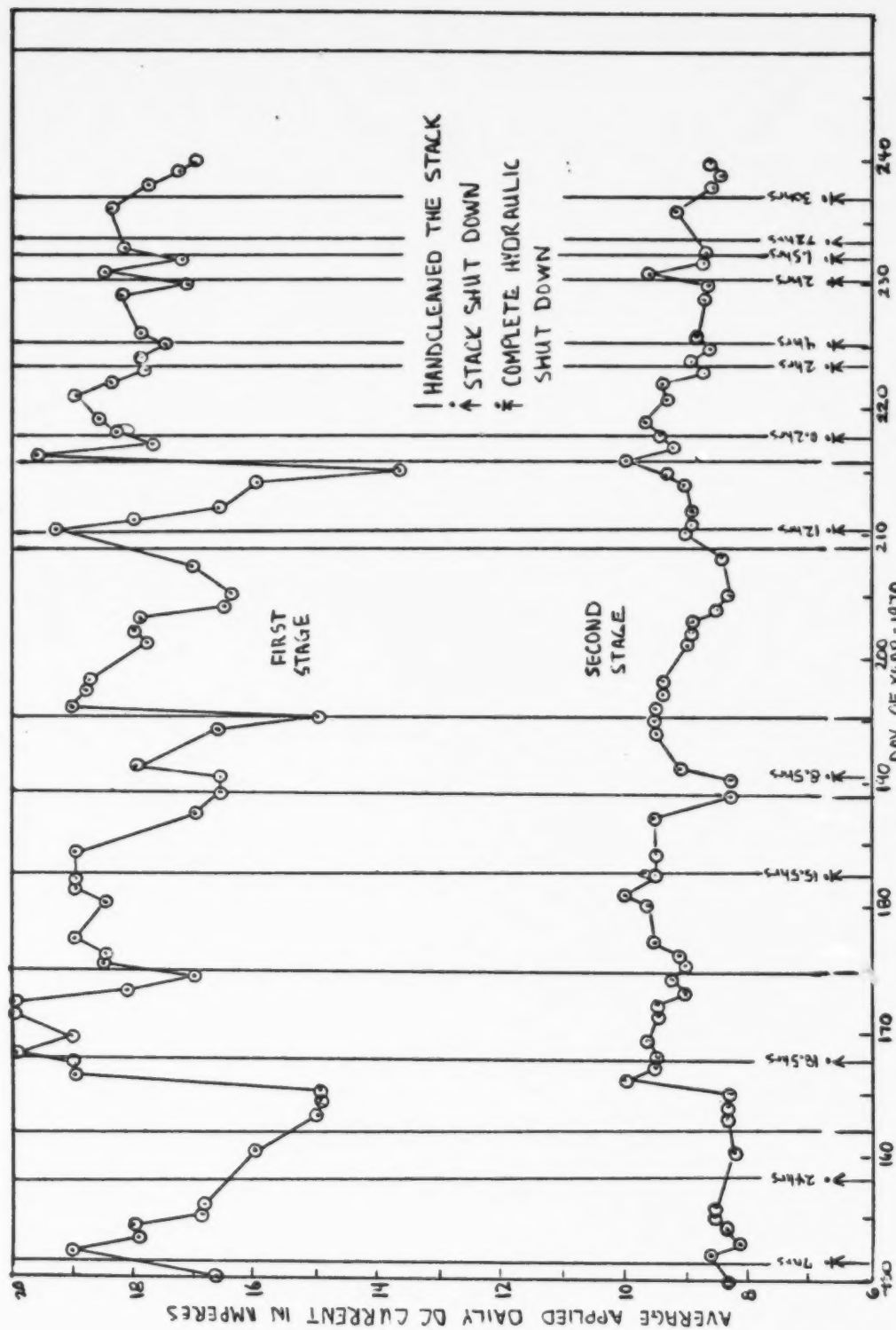


FIGURE 25. AVERAGE DAILY APPLIED DC CURRENT DURING THE FIRST PERIOD

extreme fouling, day 215. The second stage had a high of 10 amps after the handcleaning on day 162, and 8.3 amps after extreme fouling, day 189.

Figure 25 can be compared with Table 10 to show the rate of amperage decline with different quality influent. A good example is the run from 209 to 216 where algae from upstream cleaning lodged in the tracks of the first stage flow path. This decreased the diluting stream flow rate which increased the polarization layer development and membrane resistance. This increase in resistance is reflected as the sudden decline of the first stage amperage. The fact that the algae was lodged in the first stage and did not reach the second stage, is evident in the concurrent high second stage DC amperages.

Initial and final total stack DC amperages for most runs are given in Table 12. The averages of total stack amperage and diluting stream pressure were calculated from Tables B-1 and B-2 from Appendix B. pH and micromhos/cm averages were calculated from chemical analysis data for the electrodialysis influent of Table D-1 in Appendix D. Specific conductance percent removal and current efficiency variables were taken from Appendices B and D.

The major trends of the electrodialysis operational parameters are present in Run 12-176 of Table 12. Total stack DC amperage decreased from 26.4 amps at handcleaning to 19.4 amps at run termination. Diluting stream influent pressure increased from 19.8 psig to 23.1 psig indicating fouling of the stream flow path. Total percent removal of the specific conductance declined as the membrane resistance increased, falling from 59 percent to 39 percent. Current efficiencies for the run were high, averaging 0.94.

DILUTING STREAM INFLUENT PRESSURE

As the stack became more fouled, organic slime and inorganic deposits would collect on the cross members (turbulence promoters), across the track flow path. These deposits would hinder the flow and raise the diluting stream influent pressure. The extent of this increase is given in Table 12 and illustrated in Figure 26. An example of the rate of diluting stream influent pressure increase is Run 216 to 240. After handcleaning, the daily average influent pressure was 18.3 psig and rose to 24 psig during the twenty-four days of operation.

INFLUENT WATER pH

Because of the upstream recarbonation, the influent water varied from a pH of 6.7 to a pH of 9.1. In some periods, the recarbonation unit did not operate and in others it operated sporadically. During these times, the pH of the influent water was in the high 8's or low 9's. After January, 1971, the pH of the recarbonation unit effluent was set and maintained near 8.0 in order to keep the effluent water stable.

TABLE 12 INITIAL (i)-AFTER HANDCLEANING, FINAL (f)-AT EXTREME FOULING, AND AVERAGE VALUES FOR RUN PARAMETERS

Run Duration Day of the Year	Total Stack Amperage in amps		Diluting Stream Influent Pressure		Ave Inf't Micro- mhos/cm	Specific Conductance Total Per- cent Removal	Current Efficiency							
	i	f	ave	psig			i	f	ave	i	f	ave		
1970														
195 - 209	28.5	25.8	27.0	19.5	22.8	20.7	7.2	1546	61	60	0.80	0.92	0.79	
209 - 216	28.9	22.6	25.4	22.0	22.0	21.8	7.9	1584	57	42	0.73	0.75	0.73	
216 - 240	29.6	25.0	27.0	18.3	24.0	20.8	7.5	1510	59	56	0.82	0.82	0.74	
240 - 316	25.6	22.9	25.5	21.7	24.0	22.5	7.4	1618	56	50	0.82	0.84	0.83	
316 - 350	22.7	23.0	23.0	19.3	19.6	19.4	8.5	1586	57	52	1.00	0.89	0.93	
350 - 12	27.0	22.8	24.5	19.8	19.1	19.5	8.6	1650	61	61	0.93	1.11	0.93	
1971														
12 - 176	26.4	19.4	23.5	19.8	23.1	22.2	7.9	1720	59	39	54	1.00	0.83	0.94

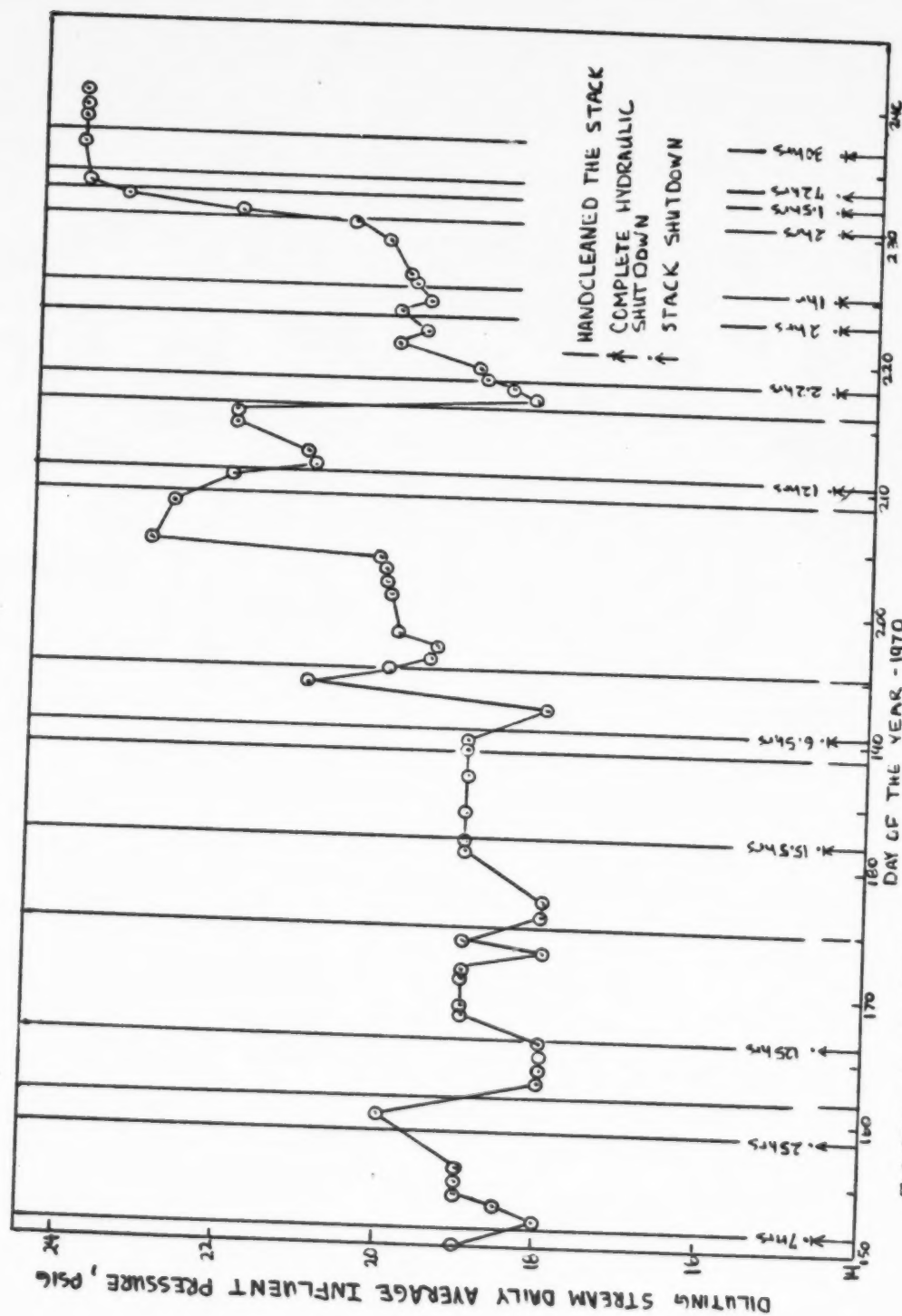


FIGURE 26. DILUTING STREAM DAILY AVERAGE INFLUENT PRESSURE DURING THE FIRST PERIOD

The electrodialysis effluent was usually about 0.5 pH units less than the electrodialysis influent. This was a result of the slight dissociation of water during normal operations. With this in mind, Table 12 indicates that the average electrodialysis effluent water was either neutral or slightly basic.

INFLUENT WATER CONDUCTIVITY

The influent water conductivity varied from 1100 to 1837 micromhos/cm during the year and one-half study period. There were three main reasons for the fluctuation: The varying sewage effluent quality, which depended on the efficiency of the upstream primary and secondary plant; the Colorado River drinking water supplied to the Santee community increased in conductivity during the study period; and the upstream reactor-clarifier varied in its removal of organic matter, alkalinity, and hardness from the secondary effluent. The average conductivities for most runs are shown in Table 12.

INFLUENT WATER TEMPERATURE

The average influent water temperature for the study period was 21.7°C. The temperature range in August, 1970 was from 25°C in the morning to 29°C in the afternoon. The winter temperature range was from 13°C to 20°C.

TOTAL PERCENT DEMINERALIZATION

Initial and final specific conductance removals for most runs were given in Table 12. The removals, which were based on micromhos/cm, began in the high 50's and low 60's after handcleaning, and declined between the high 30's and mid 50's after fouling. The rate at which the percent removal declined depended on the extent of fouling and polarization.

A comparison of the percent removals, based on the total dissolved solids after evaporation and the specific conductance of the electrodialysis influent and effluent, is made in Table 13. All total dissolved solids (TDS), and specific conductance values were taken from the chemical analysis data in Appendix D. Percent removals based on specific conductance were usually slightly higher than those based on TDS.

The monthly averages of the electrodialysis influent and effluent TDS and the specific conductance are shown in Figures 27 and 28. The averages were calculated from the chemical analysis data in Appendix D. The lowest TDS monthly average of 500 mg/l occurred in June, 1970 and the highest average of 750 mg/l in May, 1971. The average specific conductance low of 670 micromhos/cm was in July, 1970 and the high of 950 micromhos/cm in March, 1971.

The electrodialysis effluent was always of better quality than the water supplied to Santee. The Colorado River drinking water averaged

TABLE 13 ELECTRODIALYSIS AVERAGE PERCENT REMOVAL BASED ON TOTAL
DISSOLVED SOLIDS AND SPECIFIC CONDUCTANCE

Month	Year	P e r c e n t R e m o v a l			
		Based on Total Dissolved Solids After Evaporation mg/l		Based on Specific Conductance micromhos/cm	
		Ave.	Range	Ave.	Range
March	1970	52	49 - 60	---	-----
April		52	48 - 55	---	-----
May		50	48 - 63	---	-----
June		55	52 - 62	54	51 - 60
July		53	42 - 60	57	51 - 62
August		50	42 - 59	50	30 - 60
September		---	-----	---	-----
October		52	51 - 56	56	39 - 62
November		---	-----	---	-----
December		49	-----	49	-----
January	1971	51	47 - 54	51	52 - 53
February		50	40 - 59	55	53 - 56
March		50	42 - 53	47	33 - 53
April		48	44 - 52	49	46 - 53
May		45	39 - 53	47	40 - 55
June		47	30 - 60	48	39 - 58

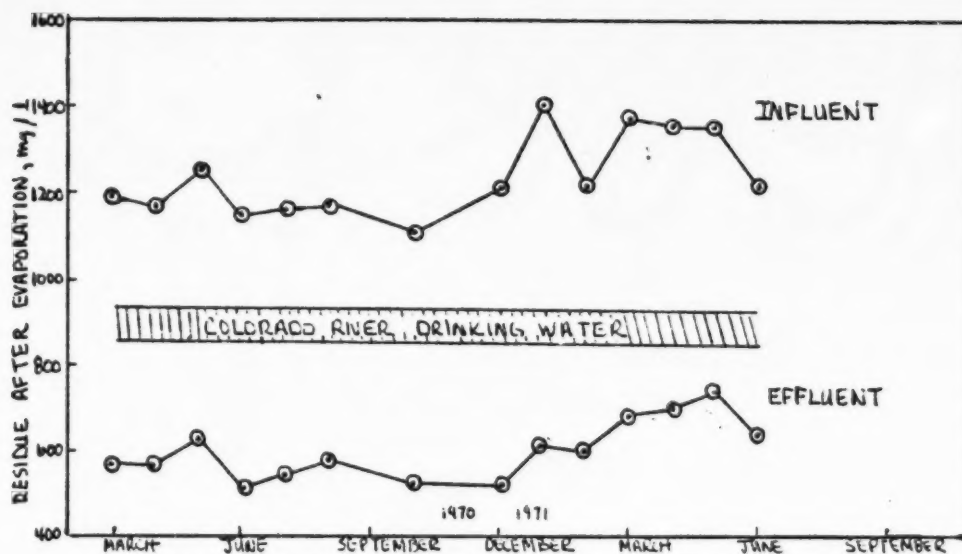


FIGURE 27. MONTHLY AVERAGE ELECTRODIALYSIS INFLUENT AND EFFLUENT TOTAL DISSOLVED SOLIDS AFTER EVAPORATION

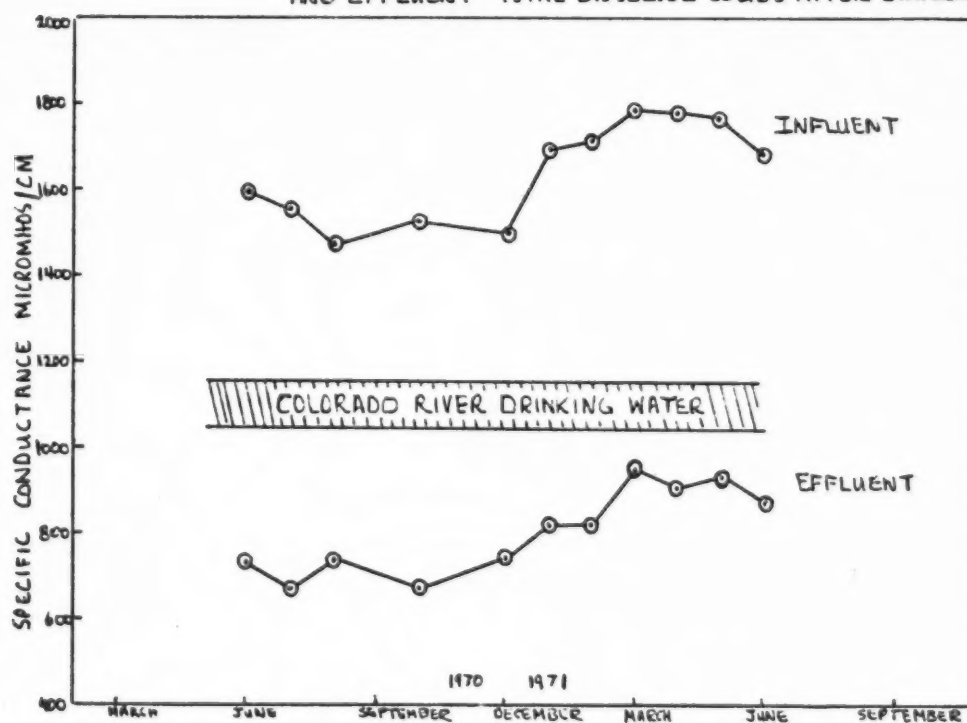


FIGURE 28. MONTHLY AVERAGE ELECTRODIALYSIS INFLUENT AND EFFLUENT SPECIFIC CONDUCTANCE

880 mg/l TDS during the study period while the electrodialysis effluent ranged from 500 mg/l to 750 mg/l. The Public Health Service Drinking Water Standards recommended 500 mg/l TDS. The Santee drinking water average specific conductance was 1100 micromhos/cm for the study period while the electrodialysis effluent ranged from 670 to 950 micromhos/cm.

The TDS and specific conductance of the electrodialysis influent water increased over the study period. Figures 27 and 28 illustrate this increase, and the accompanying rise in the electrodialysis effluent salinity. This increase in water salinity is attributed to the general rise in the Colorado River drinking water TDS.

Specific conductances were approximately 400 units higher than the TDS. Specific conductances were converted to TDS by the equation:

$$\text{Total Dissolved Solids in mg/l} = (0.76) (\text{specific conductance in micromhos/cm}).$$

REMOVAL OF SPECIFIC IONS

Electrodialysis influent and effluent concentrations of specific ions for the one and one-half year study period are given in Table 14. The ranges presented are the highs and the lows of the analysis data of Appendix D. The available United States Public Health Service Drinking Water Standards are also given. Both the influent and effluent water are proportionately high in sulfates. If Tables 14 and 15 are compared, the electrodialysis effluent water total hardness range falls near the border between soft and moderately hard water.

Electrodialysis influent and effluent anion concentrations are graphed in Figures 29 and 30. The time period is June, 1971, a typical month of unit operations. All data points were taken from Appendix D.

A study of the graphs shows that chloride, sulphate, and phosphate removals remained fairly constant. The influent bicarbonate concentration varied along with the upstream reactor-clarifier and recarbonation operations. Nitrates and, the cation, ammonium concentrations were affected by the operations of the upstream primary and secondary plants. The removal by the electrodialysis unit of these nitrogen compounds varied considerably during this month, as it did throughout the study period. Some of the scattering of these data points was caused by the inaccuracy of the analysis at such low concentrations.

The major cation influent and effluent concentrations are shown in Figures 31 and 32. Calcium, magnesium, and total hardness influent concentrations fluctuated from day to day. The concentration of these ions was affected by the softening action of the upstream reactor-clarifier.

Composite samples of the diluting stream influent and effluent before

TABLE 14 RANGE OF ELECTRODIALYSIS INFLUENT AND EFFLUENT CONCENTRATIONS DURING THE PROJECT, WITH THE PUBLIC HEALTH SERVICE DRINKING WATER STANDARDS

Constituent	I n f l u e n t		E f f l u e n t		PHS Standards mg/l
	Range mg/l	Average mg/l	Range mg/l	Average mg/l	
Chloride-Cl	200 - 276	243	44 - 127	78	250
Sulfate-SO ₄	300 - 490	379	160 - 380	225	250
Bicarbonate-HCO ₃	78 - 384	209	40 - 174	103	---
Nitrate-N	0.02- 22.5	3.4	0.07- 25.0	2.3	10
Phosphate-P	0.03- 3.53	0.98	0.00- 2.54	0.76	---
Total Hardness-CaCO ₃	140 - 430	378	92 - 244	146	---
Calcium-Ca	46 - 163	111	24 - 129	38	---
Magnesium-Mg	0.0 - 43	24	1.5 - 22.4	12	---
Potassium-K	14 - 25	20	4 - 14	11	---
Sodium-Na	196 - 255	230	80 - 180	124	---
Ammonia-N	0.03- 14.1	3.8	0.00- 6.8	1.9	---
Turbidity-J.T.U.	0.0 - 5.5	1.2	0.1 - 2.5	1.1	5
Color-units	5 - 20	7	5 - 15	5.6	15
Total COD	0.0 - 34.0	15.3	0.0 - 21.8	10.4	---
COD-filtrate	0.0 - 24.3	13.1	0.0 - 14.7	8.8	---
Iron-Fe	0.00- 0.25	0.12	0.00- 0.32	0.10	0.3
TDS	1000 -1580	1245	400 - 990	630	500

TABLE 15 DEGREE OF HARDNESS AS RELATED TO THE RANGE OF CONCENTRATION OF TOTAL HARDNESS

Range of Concentration of Total Hardness-mg/l as CaCO ₃		Degree of Hardness
From	To	
Zero	100	soft water
101	200	moderately hard water
200	and up	very hard water

and after the handcleaning of 24 July 1970, Day 176, were sent to an outside laboratory for drinking water analysis. The results are given in Table 16.

MEMBRANE REJUVENATION METHODS

In the third period, from January 1971 to June 1971, the electrodialysis unit was operated as long as possible without membrane stack disassembly and handcleaning. Several membrane rejuvenation methods were used on a regular basis. These methods included sulfuric acid flushes, enzymatic detergent flushes, complete and membrane stack shutdowns, and air injection. Procedures for these operations are explained in the Methods Section.

Shutdowns

Shutdowns were the first of the membrane rejuvenation methods used when the applied stack DC amperage fell slightly below its normal operating range. If the decline in the applied DC amperage during normal operations was too great, or if the shutdowns had little effect, then sulfuric acid or enzymatic membrane stack flushes were used. Complete hydraulic and membrane stack shutdowns of different time lengths were attempted throughout the study period. The stack shutdown data are gathered in Table 17, and the complete hydraulic shutdown data in Table 18.

Shutdown time lengths from one to two hours were found to be effective in increasing the applied DC amperage and decreasing the membrane resistance. As can be seen in Table 17 and 18, down times less than one hour had varying results. There was little change in the applied DC amperage increase or membrane resistance decrease after two hours of shutdown time.

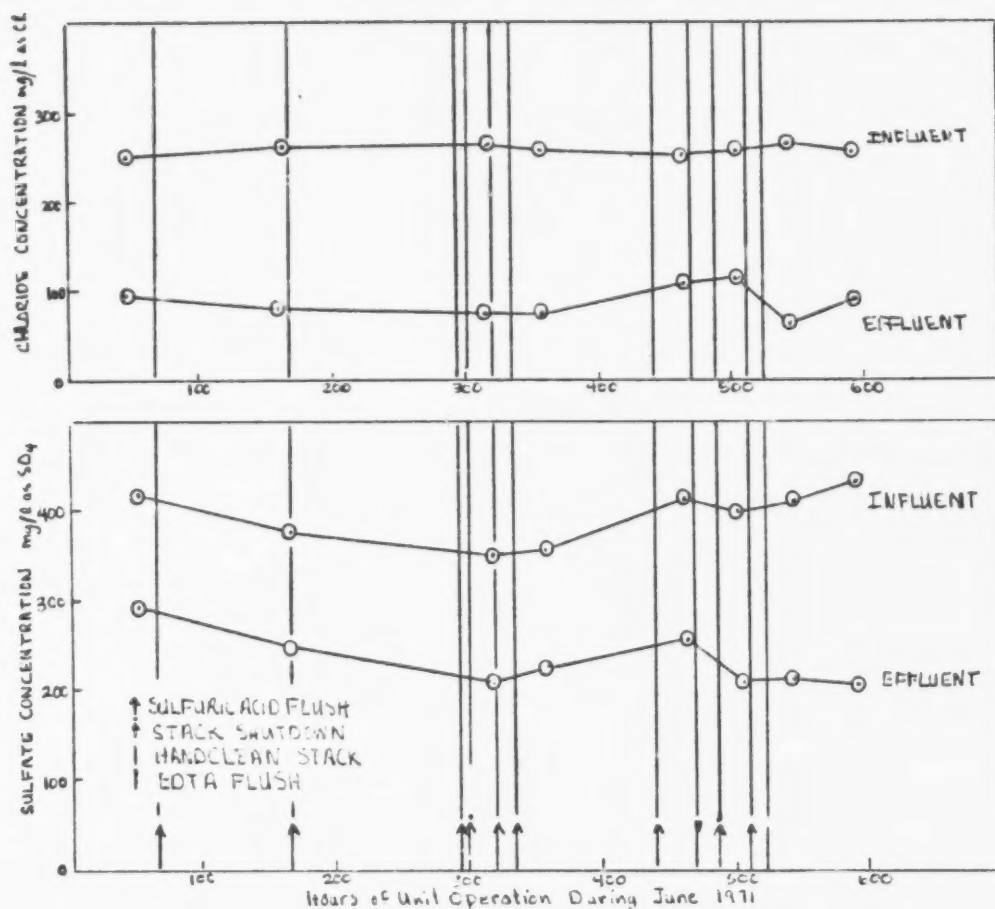


FIGURE 29. INFLUENT AND EFFLUENT ELECTRODIALYSIS ANION CONCENTRATIONS DURING JUNE 1971.

Acid Flushes

The applied DC amperage was used as the criterion for flushing the membrane stack with sulfuric acid. When the DC amperage fell below the normal operating range, a sulfuric acid flush was performed. Table 19 gives the sulfuric acid and enzymatic detergent flush schedule along with their effects on the first stage applied DC amperage and membrane resistance. The specific conductance percent removal by the entire membrane stack, or specific conductance total percent removal, is also included.

As Table 19 indicates, the amount of applied DC amperage increase varied for each sulfuric acid flush. The effects of the sulfuric acid flushes appeared to be dependent on the degree of fouling, composition of the deposit, and the location of the deposition. For instance, the flushes had more effect on carbonate deposits than

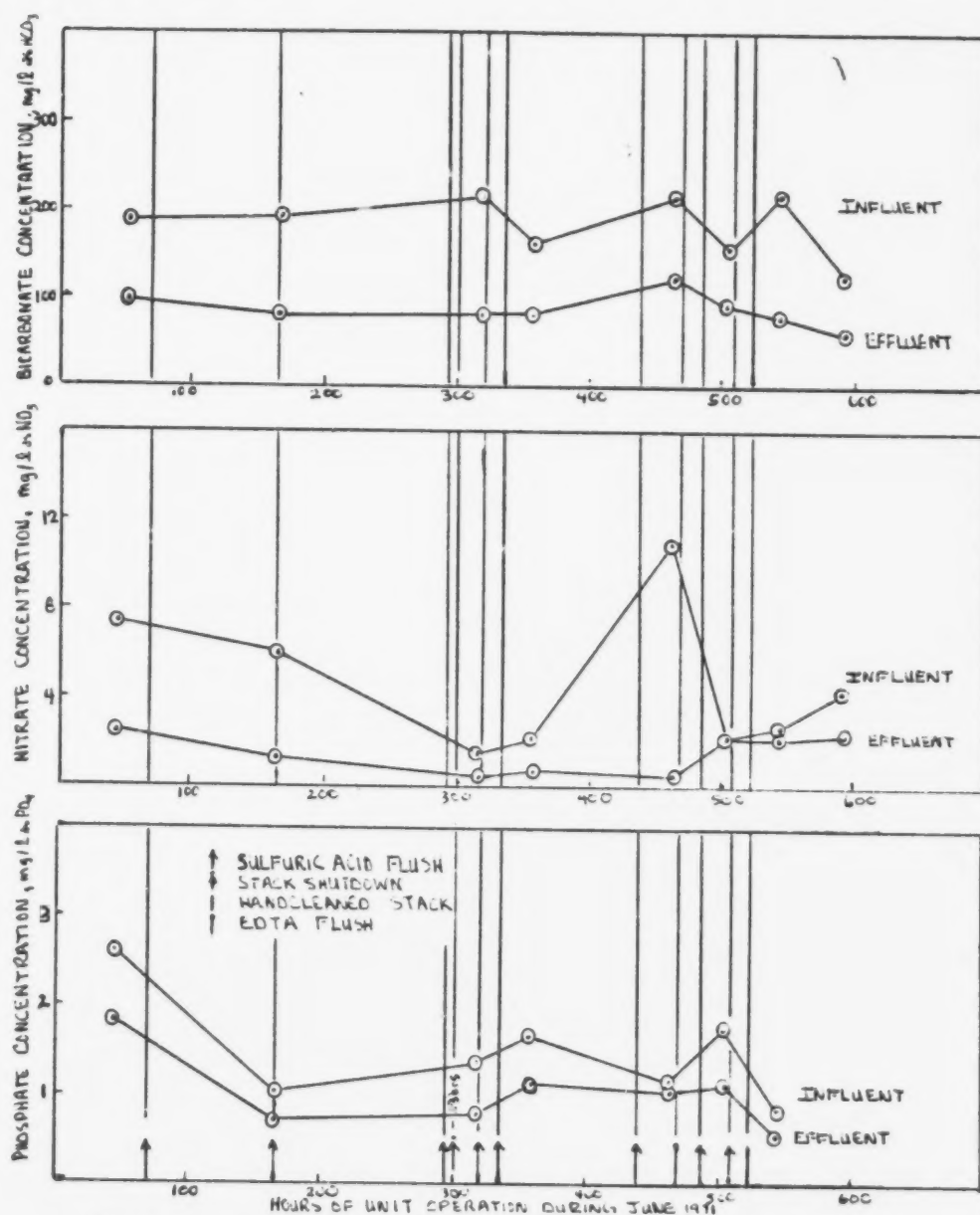


FIGURE 30. INFLUENT AND EFFLUENT ELECTRODIALYSIS ANION CONCENTRATIONS DURING, JUNE 1971

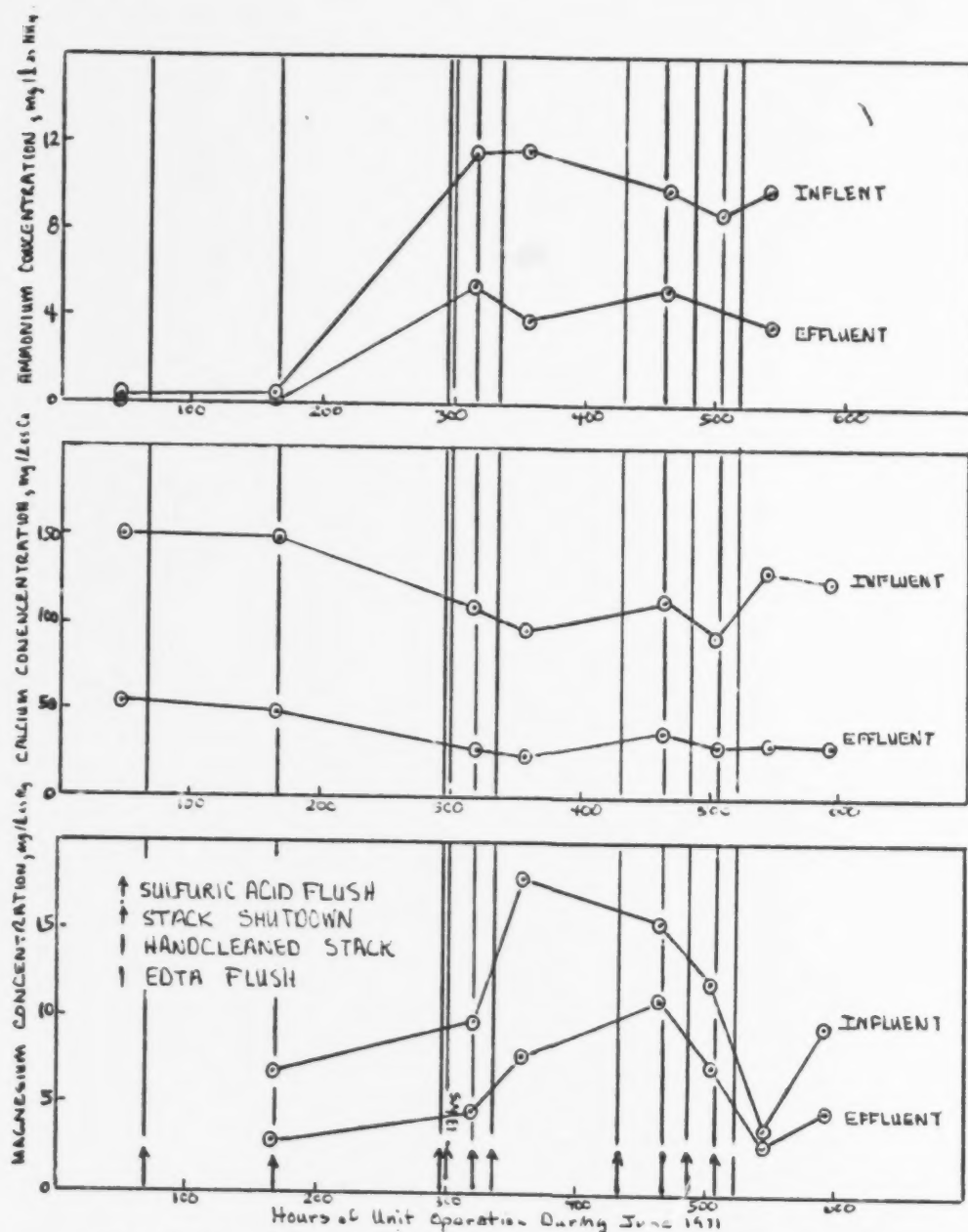


FIGURE 31. INFLUENT AND EFFLUENT ELECTRODIALYSIS CATION CONCENTRATIONS DURING JUNE 1971.

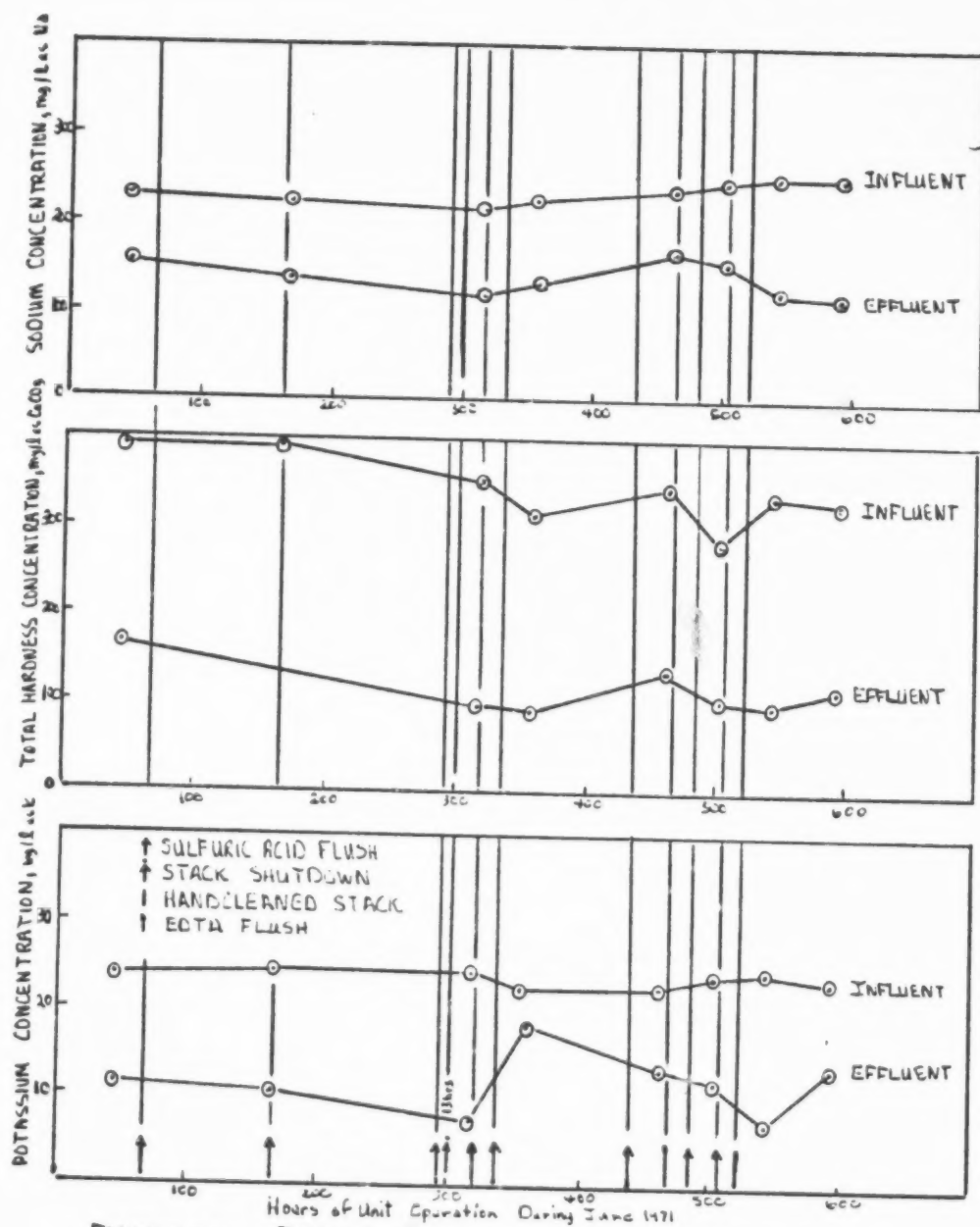


FIGURE 32. INFLUENT AND EFFLUENT ELECTRODIALYSIS CATION CONCENTRATIONS DURING JUNE 1971

TABLE 16 ADVANCED WASTE TREATMENT RESEARCH LABORATORY ANALYSIS OF THE ELECTRODIALYSIS DILUTING STREAM INFLUENT AND EFFLUENT BEFORE AND AFTER THE HANDCLEANING OF 24 JUNE 1971

Test	Before Hand-Cleaning (6/14/71)		After Hand-Cleaning		USPHS Recommended Limits (1962)
	Influent	Effluent	Influent	Effluent	
Sodium-Na	251.	141.	256.	104.	---
Potassium-K	19.5	8.4	20.	6.4	---
Calcium-Ca	155.	51.	131.	40.	---
Magnesium-Mg	1.6	0.6	2.9	1.1	---
Ammonia-N	0.4	0.2	7.9	2.5	---
Nitrite-N	0.1	0.1	1.6	0.5	---
Nitrate-N	21.8	7.0	7.0	1.4	10.
Total Kjeldahl-N	0.8	0.6	9.2	3.1	---
Iron-Fe	0.1	0.1	0.1	0.1	0.3
Aluminum-Al	1.0	1.0	1.0	1.0	---
Copper-Cu	0.1	0.1	0.1	0.1	1.0
Chromium-Cr	1.0	1.0	0.1	0.1	---
Manganese-Mn	0.1	0.1	0.1	0.1	0.05
Zinc-Zn	0.1	0.1	0.1	0.1	5.0
Mercury-Hg	0.2*	0.2*	2.0*	0.8*	---
Sulfate-SO ₄	350.	210.	380.	200.	250.
Chloride-Cl	257.	77.	260.	60.	250.
Bicarbonate-HCO ₃	140.	65.	140.	55.	---
pH (units)	7.1	6.9	7.8	6.9	---
Phosphate-P	0.3	0.3	0.5	0.3	---
Total Dissolved Solids	820.	480.	1160.	460.	500.
Turbidity (J.U.)	1.5	1.2	1.7	1.7	5.
COD	16.0	11.5	22.2	12.3	---
TOC	4.2	4.4	5.8	4.8	---
Cadmium-Cd	0.1	0.1	0.1	0.1	---

*parts per billion

organic slime deposits. There also seems to have been a level of fouling where acid flushes were not able to recover the original parameters.

The applied DC amperages for May 1971 are illustrated in Figure 33. There was a twenty to thirty percent increase in the first stage amperage after each sulfuric acid flush during this month. The maximum second stage increase was near ten-percent.

TABLE 17 EFFECT OF STACK SHUT DOWNS ON STACK AMPERAGE, PRESSURE, AND MEMBRANE RESISTANCE

Date	Day of Year	Length of Shut Down Hours	Amperage amps		Diluting Stream Influent Pressure psig		Membrane Resistance ohms-cm ²					
			1st Stage Before After	2nd Stage Before After	Before	After	1st Stage Before After	2nd Stage Before After				
1970												
8/13	225	4.00	17.0	17.9	8.8	8.4	20.0	19.8	93.3	67.3	56.8	10.7
8/21,24	233/236	72.00	18.2	18.4	9.7	9.2	24.0	24.0	138.0	100.4	171.3	98.5
1971												
1/13	13	0.40	16.0	16.0	8.2	8.2	19.5	19.5	124.4	130.7	193.8	190.4
2/8	39	1.00	11.7	15.2	8.1	7.8	20.5	21.0	214.9	124.7	306.0	171.5
3/15	74	2.00	14.0	16.0	8.5	8.6	21.5	21.8	204.8	160.4	315.6	242.7
3/18,19	77/78	9.00	16.3	17.6	8.4	8.6	21.2	21.8	156.8	126.4	253.9	210.0
3/25	84	2.00	14.8	16.2	8.0	8.1	21.8	21.2	206.5	178.5	335.9	281.8
4/6	96	1.00	15.5	17.9	8.4	8.5	21.8	22.2	179.2	110.9	318.2	150.2
4/12	102	0.58	15.1	16.1	8.3	8.4	22.0	22.0	152.5	147.3	254.2	227.9
6/11	162	0.38	15.6	16.8	2.6	8.6	24.3	23.2	153.2	135.3	230.9	211.0

TABLE 18 EFFECT OF COMPLETE HYDRAULIC SHUT DOWNS ON STACK AMPERAGE PRESSURE, AND MEMBRANE RESISTANCE

Date	Day of Year	Length of Shut Down Hours	Amperage amps		Diluting Stream Influent Pressure psig		Membrane Resistance ohms-cm ²	
			1st Stage Before	2nd Stage After	Before	After	1st Stage Before	2nd Stage After
1970								
8/11	223	2.00	17.5	18.0	8.9	8.7	19.5	20.0
12/14,15	348/349	24.50	16.8	15.9	8.1	7.4	19.6	19.0
							87.3	62.3
							102.1	45.1
							76.0	53.8
							100.8	
1971								
2/9	40	1.00	11.0	16.3	7.4	7.7	20.3	21.2
2/19,22	50/53	68.00	16.9	17.2	8.1	8.3	21.2	21.3
2/22	53						103.7	125.0
3/8,12	68/71	69.00	17.0	17.5	8.2	8.4	21.0	21.8
3/12	71						112.6	167.9
4/17	107	0.88	13.2	16.8	7.7	8.4	22.5	22.2
4/19	109	3.08	13.0	16.8	7.6	8.4	21.0	21.9
4/20	110	0.50	14.0	15.8	7.9	8.0	22.5	22.3
							210.8	125.0
							396.4	222.8
							---	---
							---	---
							---	---

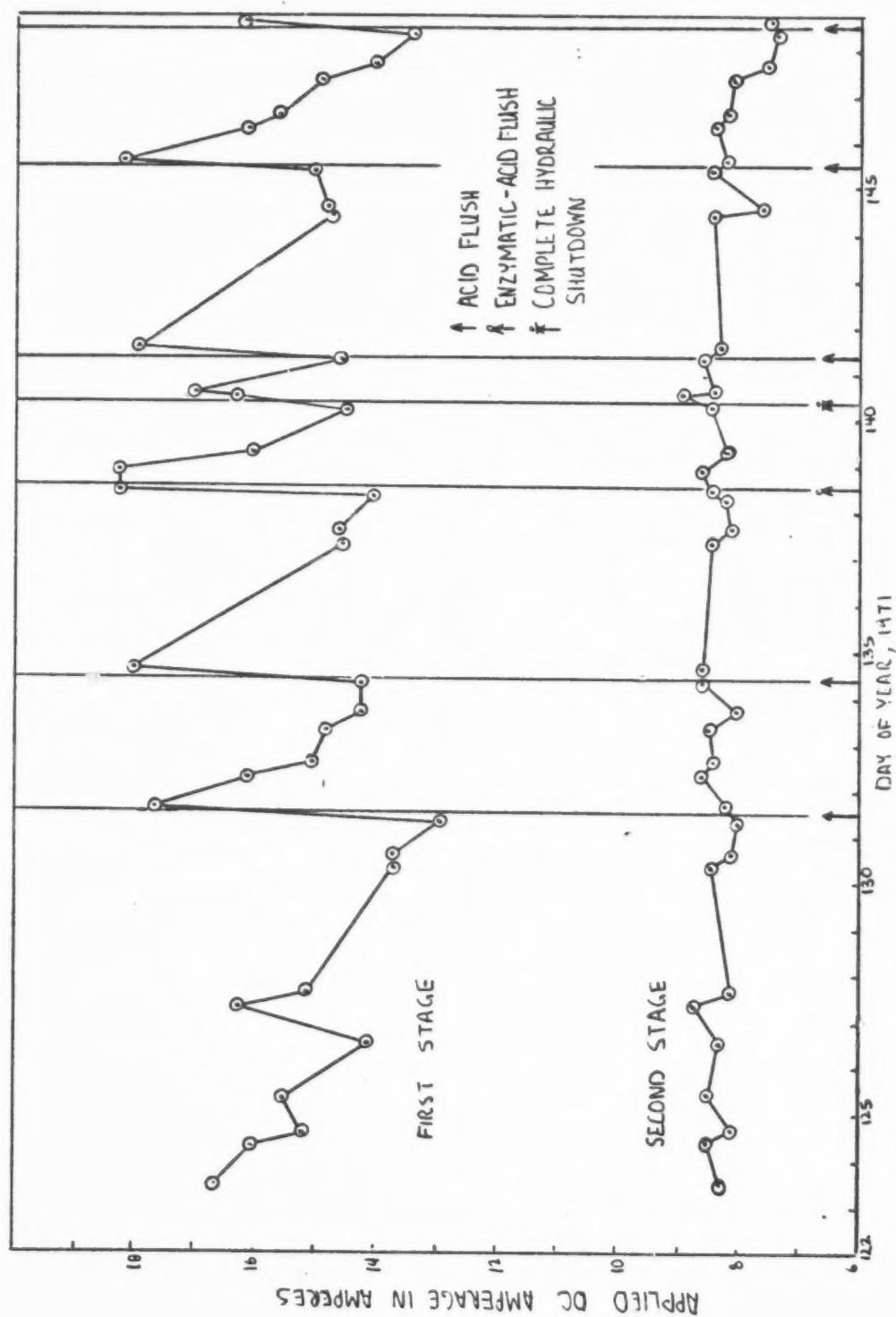


FIGURE 33. APPLIED DC CURRENT DURING MAY 1971.

TABLE 19 EFFECTS OF SULFURIC ACID AND ENZYMATIC DETERGENT FLUSHES ON AMPERAGE, SPECIFIC CONDUCTANCE PERCENT REMOVAL, AND MEMBRANE RESISTANCE.

Date 1971	Day of Year Biz	Acid	1st Stage Amperage, amps		Conductance Total Per- cent Removal		Membrane Resistance 1st Stage ohm-cm ²	
			Before	After	Before	After	Before	After
1/14	14		14.0	14.2	54	56	152	211
15		15	12.5	16.8	--	--	---	---
2/19		50	15.2	17.1	53	58	133	102
26		57	15.9	16.8	58	61	133	106
3/5		64	16.5	16.8	--	--	---	---
23		82	13.3	17.2	44	55	237	159
26		85	14.5	16.9	47	55	200	137
4/2		92	14.8	17.2	49	57	176	115
3	93		16.3	17.0	52	60	155	135
9		99	15.0	18.2	48	59	179	111
15		105	13.2	17.3	43	57	189	114
21		111	14.5	16.2	--	--	---	---
23	113	113	13.5	17.1	--	--	---	---
30		120	15.0	18.1	--	--	---	---
5/11		131	12.9	17.9	41	55	259	152
14		134	14.2	18.0	44	54	---	---
18	138	138	14.0	18.2	46	57	---	---
21		141	14.5	17.9	48	57	227	122
25		145	15.0	18.2	51	60	182	134
28		148	13.3	16.2	49	59	182	127
6/1		152	12.2	16.5	45	53	285	182
4		155	12.9	18.1	46	58	238	125
8		159	16.0	16.8	51	59	192	108
15	166		15.0	12.8	53	53	175	118
16		167	13.0	17.0	54	57	177	142
21		172	9.0	12.5	30	44	446	282
22		173	11.8	14.0	39	48	311	212
24		175	12.7	15.5	42	52	328	147

Calculated membrane resistances from January to June, 1971 are shown in Figure 34. As long as acid flushes were performed on a regular schedule, depending on the degree of fouling, the membrane resistance remained on an average level. In the period between Day 64 and 77 no acid flushes were executed, breaking the flushing pattern. The membrane resistance increased to a higher average level which further acid flushes did not lower. Another such break occurred between Day 120 and 131. During this time the membrane resistance increased rapidly. Figure 33 shows the accompanying decline of the first stage DC amperage.

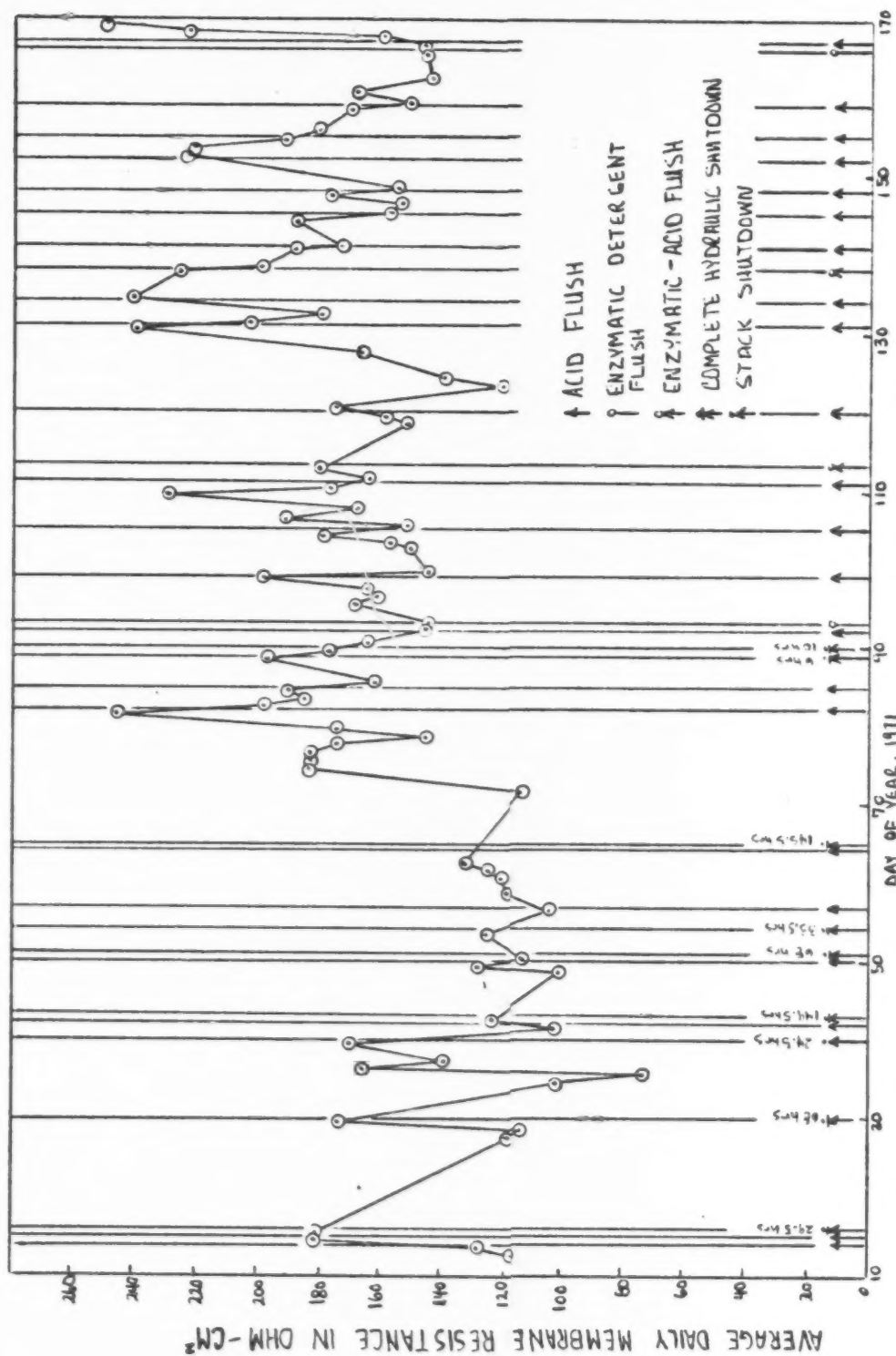


FIGURE 34. AVERAGE DAILY MEMBRANE RESISTANCE FOR THE THIRD PERIOD

Enzymatic Detergent Flushes

Five enzymatic detergent flushes were performed during the third data period. Three were enzymatic detergent flushes alone, and two were enzymatic detergent flushes followed immediately by a sulfuric acid flush and a shutdown.

Enzymatic flushes had varying effects on the membrane resistance. When performed alone, they generally increased the daily average membrane resistance. This is shown in Table 19 and Figure 34. On the other hand, enzymatic detergent flushes followed by a sulfuric acid flush and a one hour shutdown, resulted in a decrease of the membrane resistance (also Figure 34).

The effect of enzymatic detergent flushes on the applied membrane stack DC amperage is shown in Table 19 and Figure 33. The enzymatic-sulfuric acid flushes generally increased the amperage much like the sulfuric acid flushes.

Air Injection or Air Scrub

An air scrub was executed on 24 June 1971, Day 175. The membrane stack was fouled and the diluting stream influent pressure was near 25 psig. The pressure differential between the diluting and the concentrating streams was 1.35 psi. Ionics recommended a differential not more than 1.5 psi. Table 20 shows the decreasing influent pressures and the pressure differential as the air was injected into the diluting stream. The air scrub was very successful in lowering the high operating pressures.

MEMBRANE REPLACEMENT

Nine membranes were replaced in the year and one-half study period. Table 21 is a record of the membrane replacement. Two badly scaled cathode membranes were replaced in May, 1970. These were the heavy membranes which came in direct contact with the cathode waste streams. They were scaled with a carbonate compound. The two anion membranes replaced in June, 1970, were located near the cathode. They were scaled to the extent of warping the membrane. This was also a carbonate scale. The anion membranes replaced in December, 1970 and June, 1971 were slightly scaled with a carbonate compound. The cation membrane that was replaced on 24 June 1971, Day 175, had developed a hole about $\frac{1}{4}$ inch in diameter.

MEMBRANE DEPOSITS

The deposit found on the membranes when handcleaned had the same general appearance throughout the year and one-half study. It usually had a yellowish tint, slimy to touch, and clung to the membrane. It was

TABLE 20 THE EFFECTS OF INJECTING AIR (AT 35 PSIG INTO THE DILUTING STREAM) ON THE DILUTING STREAM INFLUENT PRESSURE.

Air Injection Into Diluting Stream	Diluting Stream Flow-gpm	Diluting Stream Influent Pressure psig	Diluting/Concentrating Stream Differential Pressure psi
Before	31.5	24.9	1.35
After 10 min	31.5	24.4	1.20
After 30 min	31.5	24.0	1.00
After 60 min	31.5	23.0	0.50

easily cleaned off with the palm of the hand or a wet rag. The deposit layer had a texture much like a layer of dust.

When the membranes were handcleaned on 24 June 1971, Day 175, samples of the deposit on the diluting stream sides of both the anion and cation membranes were sent to the Advanced Waste Treatment Research Laboratory of R.A. Taft Water Research Center in Cincinnati, Ohio. Table 22 is the results of that analysis.

When interpreting Table 22, the method the samples were collected must be considered. As the membranes were cleaned, the cation membrane was taken off, turned over, and the surface deposit was collected in bottles. This would give a good analysis of what was clinging to its surface. After the cation membrane was cleaned, the spacer was removed and placed on top of the cation membrane. The deposit on the anion membrane surface under the spacer was then collected in sample bottles. This sample would contain any debris which had fallen off the spacer when it was removed. It would also contain any insoluble substances which had settled out of solution or had dislodged from the cation membrane surface. After considering this, the anion membrane analysis cannot be considered as representative of the actual membrane deposit as the cation analysis.

Both deposits had COD's near 400 mg/l, and TOC's around 90 mg/l. These deposits were expected to be high in organics. The high sodium values in the cation membrane deposit indicated the presence of noncarbonate hardness such as sodium sulfate (Na_2SO_4). The cation membrane deposit was expected to have a higher proportion of inorganic matter than the anion membrane deposit. This was evidenced in the 1500 mg/l TDS on

TABLE 21 SCHEDULE OF MEMBRANE REPLACEMENT

Handcleaning	Number of Membranes Replaced	Type of Membrane	Reason For Replacement
1970			
22 May	2	Cathode	Badly scaled
24 June	2	Anion	Badly scaled
16 Dec	1	Anion	Scaled
1971			
24 June	3	Anion	Scaled
	1	Cation	Quarter inch hole

the cation membrane surface as compared to 1000 mg/l TDS on the anion membrane surface.

The aluminum on the anion membrane was thought to have come from the lime used in the reactor-clarifier. The composition of the lime was: 96.5 to 98.0 percent calcium oxide (CaO), 0.6 to 1.2 percent magnesium oxide (MgO), 1.0 to 1.5 percent silica (SiO₂), and 0.5 to 1.0 percent alumina (Al₂O₃) (3). Although the daily concentration of aluminum was small, less than 1 mg/l, a deposit of the proportions found on the anion membrane could have collected over the 6 month operational period (January - June 1971). This would also raise questions as to the use of alum upstream of an Electrodialysis unit.

The cross members and tracks of the spacers were usually covered with a slimy substance brownish green in color. The buildup would sometimes form strands with one end attached to a cross member and the other free in the stream flow path. The spacers were easily cleaned off with a strong jet of water or with a soft fiber brush.

POLARIZATION

As the membrane stack becomes more fouled, the value of the limiting current density decreases. This is the point at which the polarization layers become well defined. The applied current ceases to be passed completely by the ions present in the bulk solution, which are scarce

TABLE 22 ADVANCED WASTE TREATMENT RESEARCH LABORATORY ANALYSIS OF
THE DEPOSITS FOUND ON THE MEMBRANES AT THE HANDCLEANING
OF 25 JUNE 1971

Analysis as mg/l		
Test	On the Diluting Side of the Anion Membrane	On the Diluting Side of the Cation Membrane
Sodium-Na	148.	358.
Potassium-K	9.8	35.
Calcium-Ca	103.	88.
Magnesium-Mg	31.7	16.6
Ammonia-N	3.0	12.9
Total Kjeldahl-N	26.1	36.8
Iron-Fe	1.2	2.8
Aluminum-Al	106.	7.0
Copper-Cu	0.8	0.9
Chromium-Cr	0.1	0.1
Manganese-Mn	0.2	0.2
Zinc-Zn	0.3	1.6
Sulfate-SO ₄	380.	440.
Chloride-Cl	160.	360.
Bicarbonate-HCO ₃	150.	244.
pH (units)	7.2	7.4
Phosphate-P	44.2	6.5
Total Dissolved Solids	1050.	1510.
Turbidity (J.U.)	95.0	55.0
COD	393.	395.
TOC	102.	82.
Cadmium-Cd	0.1	0.1

near the membrane surface, and begins to be partially passed by the hydroxide and hydrogen ions of the stream water.

The two most frequent causes of polarization, during normal operations, are fouling of the membrane surface and fouling of the track flow path. Deposits on the membrane surface increase the thickness of the boundary layer. This lowers the limiting current density and the point at which polarization occurs. Any fouling of the flow path decreases the flow rate. Lower flow rates decrease the turbulence near the membrane surface and the time in which the ion concentrations near the surfaces are depleted.

If the DC voltage is graphed versus the DC applied current, the point at which the limiting current density occurs may be seen. This is

revealed as an inflection where the slope increases.

In field testing, however, this point is not usually well defined. This is because there is competition between the dissociating water and the ions in the bulk solution at the point of polarization. The phenomenon is also complicated by changing turbulence and diffusion affects. As a result, the change of slope, if it occurs, usually presents itself as a zone along the voltage-amperage curve.

Three polarization tests are illustrated in Figure 35. These three tests were taken over the year and one-half study period under different stack conditions. The test on 27 July 1970, Day 208, gave the only definite change of slope. This test was taken on the last full day of the run from Day 195 to 209. Figures 25 and 26 illustrate the low amperage and high pressures at the end of this run. Residual algae from upstream cleaning had lodged in the flow path of the membrane spacer tracks. This resulted in higher influent pressures and a lower diluting stream flow rate of 29.5 gpm. This lower flow rate increased the possibility of polarization occurring.

The polarization test on 29 January 1971, Day 29, gave little indication of a change of slope. The first stage, during this test, was more fouled with organic slime than that on 27 July 1970, Day 208. This fouled condition appears to have moved the voltage-amperage curve to the left.

The polarization test on 30 June 1971, Day 181, was taken immediately after the handcleaning on 25 June 1971, Day 176. This curve was much to the right of the curve on 29 January 1971, Day 29.

NORMALITY VERSUS SPECIFIC CONDUCTANCE

Least squares fits were used to establish the equations for the linear relationship between the specific conductances and solution normalities (mev/l) derived from analysis. There were two periods of data taking: one period from May through August, 1970 and the other from January to June 1971. The least square fit for the first period is shown in Figure 36 and for the third period, Figure 37. The sums of the independent solution normality and the dependent specific conductance variables are given in Appendix A, Table A-1.

CURRENT EFFICIENCY

Current efficiencies were calculated using the equation in the Theory Section. Data for the variables were taken from Appendix B. The average current efficiencies for all runs after 14 July 1970, Day 195, are given in Table 23. The Ionics recommended current efficiency was between 0.85 and 0.90.

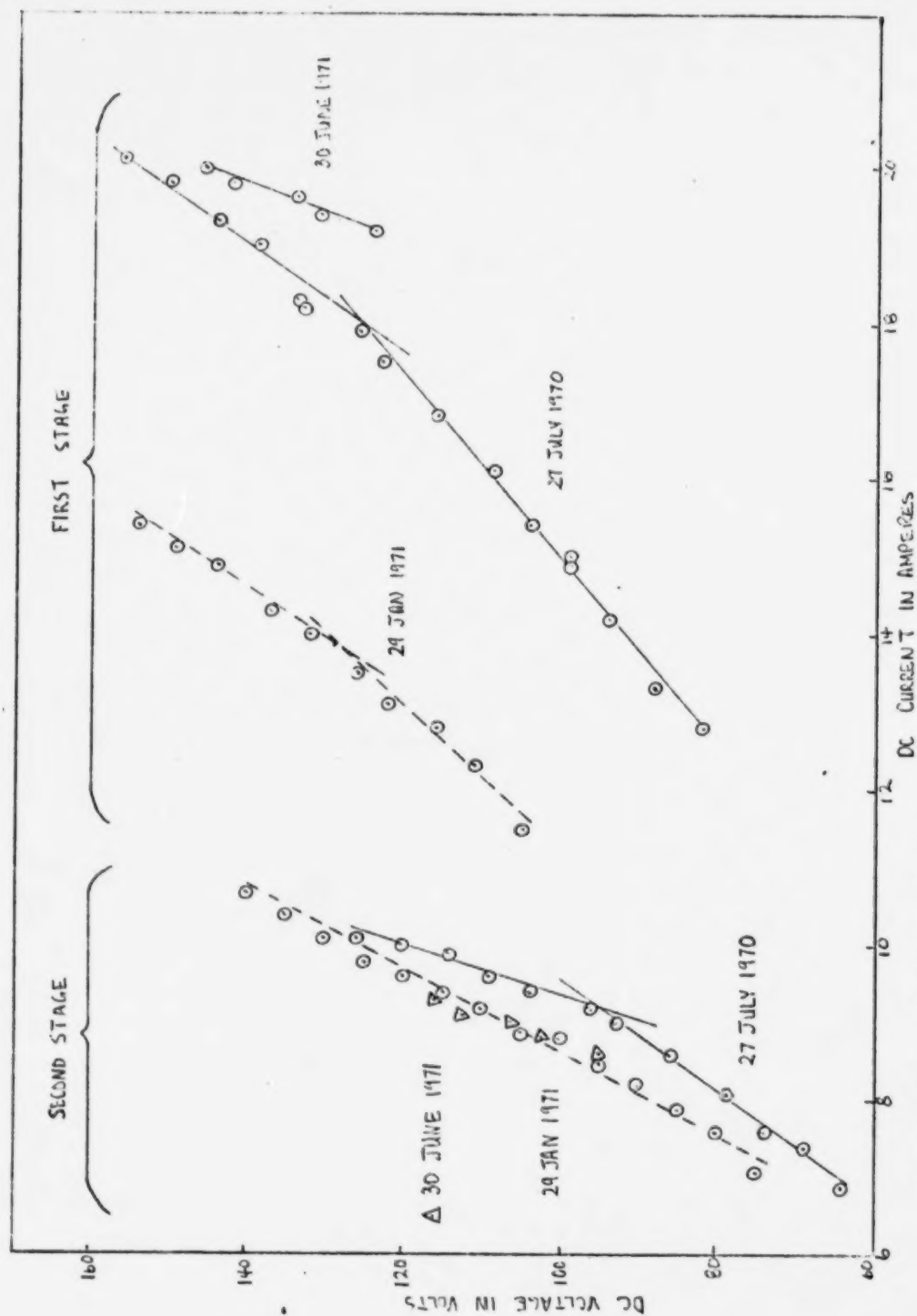


FIGURE 35. POLARIZATION CURVES

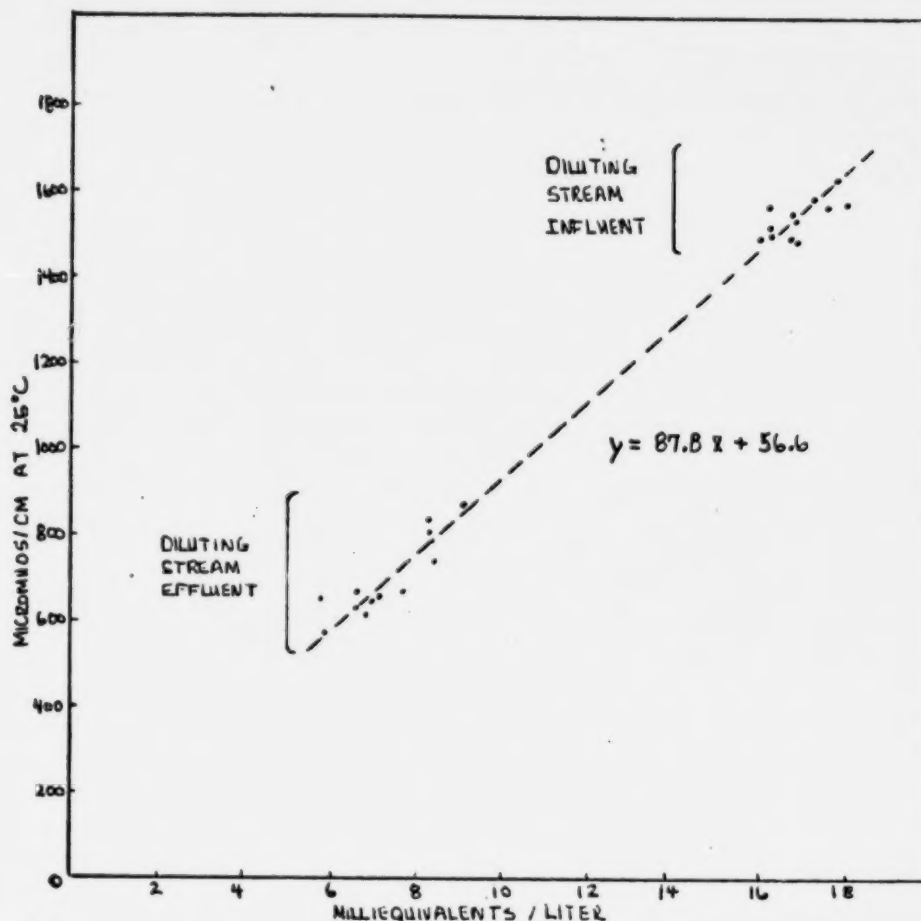


FIGURE 36. DILUTING STREAM CONCENTRATION VERSUS SPECIFIC CONDUCTANCE FOR THE FIRST PERIOD

CALCULATED MEMBRANE RESISTANCE

Membrane resistances were calculated using the equation in the Theory Section. Data for the variables were taken from Appendix B. The specific mean resistance for each stream came from Table A-2 in Appendix A. The membrane resistance values from 7 August 1970, Day 219, to 2 July 1971, Day 183, are in Table A-3 of Appendix A. They are listed as uncorrected membrane resistances.

The relationship between water temperature and membrane resistance was found by comparing succeeding membrane resistance values under similar fouling conditions (after an acid flush) and diluting stream influent specific conductance. If the fouling conditions and the influent specific conductance were constant, the change in the membrane resistance, if any, was considered a result of the temperature

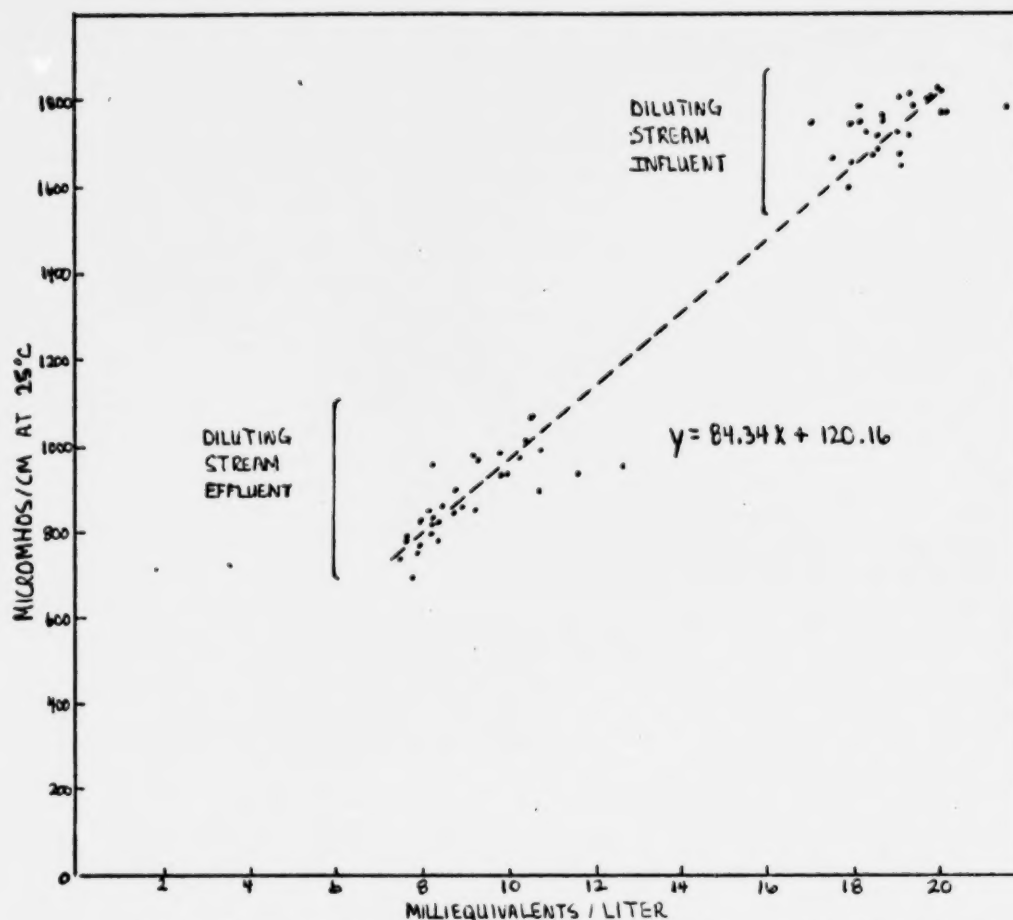


FIGURE 37. DILUTING STREAM CONCENTRATION VERSUS SPECIFIC CONDUCTANCE FOR THE THIRD PERIOD.

change. Because of widely varying diluting stream influent conductances, it was difficult to find more than two membrane resistances under the same fouling conditions and influent specific conductance. Since this was the case, five sets of two data points were used. The rate of membrane resistance change per degree centigrade was calculated for each set, and the five values were averaged. The averages are given in Table 24.

The same procedure was used for establishing the relationship between membrane resistance and the diluting stream influent specific conductance. Here, membrane resistance and diluting stream specific conductance values were taken while the water temperature was constant. Five sets of two data points were used, these averages also appear in Table 24.

TABLE 23 AVERAGE STACK CURRENT EFFICIENCY FOR EACH RUN FROM
14 JULY 1970

Run Duration		Average Stack
Date	Day of Year	Current Efficiency
1970		
14 July - 28 July	195 - 209	0.79
28 July - 4 Aug	209 - 216	0.73
4 Aug - 28 Aug	216 - 240	0.74
28 Aug - 12 Nov	240 - 316	0.83
12 Nov - 16 Dec	316 - 350	0.93
16 Dec - 12 Jan	350 - 12	0.93
1971		
12 Jan - 25 June	12 - 176	0.94

The correction factors in Table 18 were substituted as the variable f in the correction equation. All the membrane resistance values in Appendix A were corrected to a water temperature of 21.7° centigrade and a diluting stream influent conductance of 1425 micromhos/cm. These were the averages of the water temperature and the diluting stream influent conductance values for the study period. The daily average corrected membrane resistance values for the first stage (during 1971) were shown in Figure 34. They ranged from a minimum of 72 ohm-cm² to a maximum of 250 ohm-cm².

SEPARATION FACTOR

Separation factors were calculated using the equation in the Theory Section. Data were taken from chemical analysis data in Appendix E. Average separation factors and percent removals are given in Table 25. The analysis for the month of June, 1971 and August, 1970 were eleven months apart, and would reveal any long range change in the membrane characteristics. Separation factors and the percent removals varied in the daily operation, but showed no significant trends over the year and one-half study. Operation during June, 1971 was under slightly more fouled conditions than during August, 1970.

At the end of the study period, samples of the anion and cation membranes, from the first stage, were sent to Ionics Inc. for analysis. They reported essentially no change from the original properties.

TABLE 24 PERCENT CHANGE IN MEMBRANE RESISTANCE PER DEGREE CENTI-
GRADE OF THE WATER TEMPERATURE AND PER MICROMHO/CM OF
THE DILUTING STREAM LOG MEAN

Stage of Stack	Percent Change Per Degree Centigrade	Percent Change Per micromhos/cm
First	4.88	0.21
Second	4.65	0.35

TABLE 25 PERCENT REMOVAL AND SEPARATION FACTORS FOR AUGUST 1970
AND JUNE 1971

Constituent mg/l	Percent Removal		Separation Factor	
	Average	Range	Average	Range
June 1971				
Total mev/l	51	41 - 59	----	----
Total Hardness-CaCO ₃	65	58 - 72	1.29	1.14 - 1.46
Calcium-Ca	70	63 - 75	1.39	1.23 - 1.63
Magnesium-Mg	41	14 - 57	0.80	0.23 - 1.11
Potassium-K	59	40 - 75	1.07	0.75 - 1.19
Sodium-Na	41	29 - 53	0.79	0.70 - 0.94
Ammonium-NH ₄	58	52 - 100	1.14	0.73 - 1.96
Chloride-Cl	65	54 - 75	1.25	1.10 - 1.38
Sulfate-SO ₄	41	30 - 51	0.78	0.66 - 0.97
Bicarbonate-HCO ₃	50	39 - 62	0.97	0.79 - 1.06
Nitrate-NO ₃	54	00 - 94	1.06	0.00 - 2.18
Phosphate-PO ₄	29	7 - 33	0.56	0.16 - 0.71
Alkalinity-CaCO ₃	50	39 - 62	0.97	0.79 - 1.06
Total COD	21			
COD Filtrate	24			
August 1970				
Total mev/l	56	46 - 63	----	----
Total Hardness-CaCO ₃	65	59 - 69	1.16	1.10 - 1.30
Calcium-Ca	73	61 - 70	1.19	0.98 - 1.36
Magnesium-Mg	50	9 - 69	0.86	0.20 - 1.07
Potassium-K	68	51 - 87	1.19	1.11 - 1.38
Sodium-Na	57	43 - 89	0.92	0.85 - 0.99
Ammonium-NH ₄	61	18 - 00	1.06	0.29 - 1.69
Chloride-Cl	71	60 - 78	1.26	1.17 - 1.30
Sulfate-SO ₄	45	34 - 56	0.79	0.71 - 0.90
Bicarbonate-HCO ₃	53	35 - 70	0.93	0.76 - 1.18
Nitrate-NO ₃	62	40 - 72	1.10	0.80 - 1.21
Phosphate-PO ₄	30	00 - 52	0.76	0.00 - 1.90
Total COD	14			
COD Filtrate	15			

SECTION IX

DISCUSSION

STACK DC AMPERAGE AND DILUTING STREAM INFLUENT PRESSURE

Low stack DC amperage resulting from high membrane resistance was the most frequent cause for run terminations. Six out of eight runs in the first period were terminated for this reason. In each of these runs, the low amperage was caused by either organic slime or scales on the membrane surface. The remaining two runs were terminated because residual algae from upstream cleaning had lodged in the spacer flow paths and caused high diluting stream influent pressures.

As the run durations increased in length, problems with high diluting stream influent pressures became more significant. In the early runs of short duration, the DC amperages fell below the normal operating ranges before deposits could adequately collect and seriously hinder the stream flows. Because of the membrane rejuvenating methods in the third period, the DC amperages were maintained at their recommended levels. This allowed time enough for deposits to collect in the diluting stream flow path. The resulting increase in the diluting stream influent pressure was from 19 to 25 psig. Sulfuric acid and enzymatic detergent flushes were effective in maintaining the level of the applied DC amperage, but could only retard the increase in the diluting stream influent pressure. These flushes were not able to stop or reverse the trend.

The only method which significantly decreased the diluting stream influent pressure was the air scrub. Data for one such air scrub were presented in Table 21. Since the stack effluent at the time of the air scrub contained much organic matter, the lowering of the influent pressure was felt to be fairly permanent. As to how permanent, it is not clear, due to termination of the study project, time did not permit the continuation of the run.

INFLUENT SPECIFIC CONDUCTANCE

As noted in the Results Section, the influent water specific conductance rose during the year and one-half period (Figure 28). A study of the County chemical analysis of the Colorado River Aqueduct Water showed an equivalent increase in the specific conductance of the drinking water supplied to Santee. The Colorado River water composition is subject to yearly fluctuations affected by the amount of rainfall, snowfall in the adjoining mountains, and the general weather conditions in Southern California.

A rise in the electrodialysis product water TDS and specific conductance accompanied this increase in influent water conductance.

SULFURIC ACID FLUSHES

Membrane stack sulfuric acid flushes temporarily lowered the membrane resistance (refer to Figure 34). In the early part of the third period, from Day 10 to Day 70, sulfuric acid flushes were required once a week. The average membrane resistance, at this time, was near 116 ohm-cm². A break in the regular sulfuric acid flushing schedule, between Day 65 and Day 82, however, caused an increase in the membrane resistance from 112 to 182 ohm-cm². Along with this increase, the effects of the acid flushes became more temporary, requiring a rise in the acid flushing frequency from one every 7 days to one every 4.5 days. The average membrane resistance also rose to 160 ohm-cm².

Another break in the sulfuric acid flush frequency occurred from Day 120 through Day 131. This period of flushing inactivity was again accompanied by a rise in the membrane resistance from the previous 160 ohm-cm² level to 240 ohm-cm². Sulfuric acid flushes every 3.5 days, and one enzymatic-sulfuric acid flush were effective in bringing the membrane resistance down to 154 ohm-cm². After the break, however, the membrane resistance became erratic, increasing as much as 70 ohm-cm² in a 4 day period.

In explaining the effects of the sulfuric acid flushing schedule on the membrane resistance, it was felt that the acid flushes partially removed the membrane deposit, leaving a certain amount. How much remained, depended on the pH of the sulfuric acid solution and the location, amount, and composition of the deposits. As the deposits built up and the sulfuric acid flushes were carried out, the amount which remained after flushing accumulated. This boundary layer which remained, increased the average membrane resistance and, because their effects were more temporary, also increased the sulfuric acid flushing frequency. Because any break in the flushing frequency would also speed up the deposition of substances on the membrane surfaces, it was important to maintain and adhere to a regular sulfuric acid flushing schedule.

ENZYMATIC DETERGENT FLUSHES

In January, enzymatic detergent flushes were thought to have an effect upon the diluting stream influent pressure. However, as shown in the Results Section, the effect of these flushes and the enzymatic-sulfuric acid flushes on influent pressure was inconclusive. The pressure either remained the same, or increased or decreased 1 psi.

Enzymatic detergent flushes were attempted only when conditions were felt extreme. Since they were followed by a sudden change in the influent pressure, either up or down, it was felt that they were effective in loosening organic foulants. What appeared to be occurring, as evident in the last enzymatic detergent flush in Figure 34, was that either the dislodged matter was flowing through the stack thus lowering the pressure, or it was collecting at some point and blocking the

spacer track flow path and increasing the pressure.

SECTION X

COSTS

The cost of electrodialysis at Santee has been separated into construction and operation costs. Construction costs have been amortized over twenty years at 6 percent annual interest. Operation costs consist of man power, materials and outside services for maintenance, consumables, electricity, and overhead. Total costs have been given per thousand gallons of product water in Table 33.

ACTUAL COSTS

Man-hours spent on equipment and duties are tabulated in Table 26. All extra project work has been eliminated from these figures.

The 123 man-hours accumulated under sulfuric acid pump were mostly for repairs. Sixteen hours in November and December, 1970 were spent repairing the cathode stream pump head and damaged diaphragms. Failure of the backup guard diaphragm on the cathode head side of the pump allowed sulfuric acid to enter into the pump mechanism. Ninety-five man-hours in January and February were spent cleaning, repairing, and reinstalling the acid pump and the electric motor.

The acid injection system consisted of the lines between the dilute acid tank and the pump, the lines from the acid pump to the cathode and concentrating stream, and the pneumatic controller located on the concentrating stream head of the acid pump. Man-hours from April to October, 1970 were for cleaning the acid lines and check valves on either side of each head. Occasionally air became entrapped within this system. Man-hours in March and April, 1971 were for repairs on the pneumatic controller.

Man-hours under pH monitoring system were spent troubleshooting, calibrating, and repairing the electrode signal transmitter, pneumatic converter network. This network recorded the cathode stream pH and recorded and controlled the concentrating stream pH. Man-hours from October through December, 1970 were for troubleshooting a "cycling" in the system which eliminated automatic operation. The problem was isolated to a loose diluting stream ground wire and large amounts of oil and water in the air system.

Miscellaneous man-hours were for a recirculation pump repairs, wash down and cleaning, pump heater repairs, and improving the water drainage system underneath the membrane stack.

Under filters, the man-hours in May 1970, June 1970, and June 1971 were spent for routine filter replacements. However in May 1971, nineteen hours were spent replacing the lower copper seats in which the filters rested. These seats crumbled apart at disassembly and were

TABLE 26 MANHOURS FOR EACH MONTH

Month	Sulfuric Acid Pump	Acid Injection System	pH Monitoring System	Miscellaneous	Filters	High Pressure Alarm System	SHMP System	Acid Flushes	Enzymatic Deterg't Flushes	Shut Downs	Stack Hand Cleaning	Chemical Preparation	Daily Observation and Record Taking	Evening and Weekend Shifts	Administration	Totals
1971																
June	7.00	---	4.00	1.00	3.00	7.00	---	6.25	3.00	1.5	18	8.00	15.00	31.00	27	131.75
May	---	---	0.50	16.75	19.00	---	---	7.50	5.50	---	---	7.75	17.75	36.25	20	131.00
April	5.00	4.00	---	2.00	---	---	---	6.25	6.00	2.5	---	13.00	14.75	34.00	18	105.50
March	---	35.25	---	11.50	---	---	---	2.50	---	1.5	---	5.00	30.00	41.00	20	146.75
Feb	31.75	---	---	9.00	---	---	12.00	3.00	---	0.75	---	4.50	11.75	30.50	16	119.25
Jan	63.50	---	5.50	5.00	---	---	---	1.25	6.00	---	12	4.00	8.00	27.00	25	157.25
1970																
Dec	6.00	---	37.00	10.00	---	---	14.5	---	---	---	18	1.50	5.25	24.00	26	142.25
Nov	10.00	---	---	9.00	---	---	3.0	---	---	---	16	0.50	1.00	15.00	23	77.50
Oct	---	10.00	36.75	17.00	---	2.50	---	---	---	---	---	3.25	11.75	21.50	25	127.00
Sept	---	39.50	---	---	---	34.00	---	---	---	---	---	0.50	2.00	16.00	25	117.00
Aug	---	5.00	119.00	---	---	---	14.0	---	---	2.25	15	4.00	12.00	27.00	25	225.25
July	---	3.00	---	20.00	4.00	12.00	20.0	---	---	---	44	6.50	19.00	32.00	23	183.50
June	---	12.00	---	---	---	3.00	18.0	---	---	---	28	6.00	16.00	33.00	25	141.00
May	---	22.00	0.50	---	3.00	---	---	---	---	---	28	6.25	19.00	32.00	16	126.75
April	---	6.00	---	8.00	---	---	---	---	---	---	---	6.50	20.00	30.00	14	84.50
Totals	123.25	140.75	203.25	109.25	29.00	58.50	81.50	26.75	20.50	8.50	179	77.25	203.25	430.25	326	

removed and replaced with PVC receptacles.

Time accumulated under high pressure alarm system was for maintaining, troubleshooting, calibrating, and repairing the stream pressure sensors, flow gauges, and manometers.

Maintenance on the sodium hexametaphosphate (SHMP) injection system consisted of relocating the pump nearer the unit, and troubleshooting and repairing the silent rectifier shutdown system. An extra barrel was also added so that a reserve supply of SHMP would be available during weekends and long holiday periods.

Procedures for acid flushes, enzymatic detergent flushes, shutdowns, and chemical preparation are given in the Methods Section. Man-hours for chemical preparations were high in April 1971 because of difficulties with the powdered form of SHMP. The compound had to be a fine powder before it would completely dissolve. Even though it was stored in a sealed plastic container, a crust layer would form. This layer had to be ground by hand or discarded. After the powdered SHMP supply was depleted, a flake form of SHMP was purchased. The flakes did not develop the hard crust layer even when exposed to the atmosphere, and dissolved very quickly in water. This form saved considerable time in chemical preparation.

Daily observations in readings have been explained in the Operations Section. The unit was monitored evenings and weekends by the plant attendant as he made his rounds. On occasions, the weekend man would prepare dilute acid and SHMP solutions.

Administration consisted of time keeping, ordering supplies, telephone, and meetings.

Totals were above the expected normal monthly estimate of 80 man-hours. As explained above, there were many modifications and repairs associated with initial start-up and familiarization with the unit. Also some time was needed to integrate the process into the regular sewage maintenance program. The complexity of the instrumentation and systems, made preventive maintenance and frequent system checks critical for twenty-four hour operation.

Direct maintenance and repair costs are given in Table 27. The monthly average was \$113. The nature of the acid pump, SHMP system, filters, and pneumatic controller costs have been discussed above. Money for the air compressor was spent rebuilding the pump. Approximately \$60 was spent on the installation of the enzymatic detergent flushing system. Miscellaneous includes membrane replacements, outside services for gauge calibration, and many small items needed for daily operations.

Monthly power consumption is given in Table 28. Pumps included the

TABLE 23 MONTHLY EXPENSE FOR ELECTRODIALYSIS MAINTENANCE AND REPAIRS, PARTS AND SERVICES

Month	cost in dollars						
	Acid Pump	Air Compressor	Enzymatic Detergent Flush System	SHMP System	Filters	Miscellaneous	pH Monitoring System Pneumatic Converter On Acid Pump Total
1971							
June					136.95		136.95
May					7.11		94.21
April					86.10		---
Mar	76.71	20.51		3.11		5.20	307.28
Feb	215.67					13.46	229.10
Jan	123.43						123.43
1970							
Dec	85.01			15.80		55.87	156.68
Nov				9.10		16.52	25.62
Oct			58.77			10.07	68.84
Sept							---
Aug				89.65			294.65
July				47.42	20.40	25.21	98.03
June				21.62		66.00	87.62
May				7.80	10.20	60.00	78.00
April							---
Totals	500.82	62.16	58.77	194.50	55.70	111.39	201.75

TABLE 28 POWER CONSUMED IN KILOWATT-HOURS

Month	Feed, Recirculation, Acid, and Chemical Pumps	Rectifier 265 DC Volts @ 45 amps	Lights 1490 Watts	Air Compressor	Total kWh
1971					
June	2321.3	4083	925.4	470.6	7800.3
May	2623.0	4725	943.2	534.9	8826.1
April	2250.4	4112	862.6	457.7	7682.7
March	2105.0	3683	835.5	428.2	7051.7
Feb	1329.1	2302	791.5	272.5	4695.1
Jan	775.1	1155	849.2	159.1	2938.6
1970					
Dec	335.1	536	416.4	68.4	1355.9
Nov	375.2	660	390.6	76.3	1502.1
Oct	1012.2	1993	735.9	206.3	3947.2
Sept	296.3	429	439.6	61.5	1226.4
Aug	2235.5	3870	925.6	457.2	7488.3
July	2343.1	4163	960.9	476.2	7943.2
June	2355.7	4379	925.4	482.2	8142.3
May	2007.4	3979	747.4	408.0	7141.8
April	1199.7	1731	462.7	238.3	3631.7
March	673.4	1199	338.1	136.9	2347.4

3-horsepower feed pump, the 1.5-horsepower recirculation pump, and the acid and chemical pumps. The stack power in kWh was taken directly from a wattmeter. Lights include inside fluorescent lighting (twenty-four hours per day) and 150 watt outside lighting (twelve hours per day). Air compressor power is the kWh consumed by the 3-horsepower electric motor.

Table 29 gives the pump hours, the log hours of rectifier operation, and the total gallons of product water made per month. May 1971 was the highest product month with 1,368,360 gallons. The period from September through December 1970 had low product values because of various tertiary shutdowns. February and January, 1970 had low product gallonage because of acid pump repairs.

Actual operational costs are tabulated in Table 30. Sulfuric acid and SHMP are calculated at the last price paid for them. Parts and services are taken from the totals in Table 27. Power costs are calculated from the totals in Table 28. The price paid per kWh by Santee is the high-

TABLE 29 PUMP HOURS, WITH kWh's CONSUMED BY STACK AND GALLONS OF PRODUCT MADE

Month	Day of Hours in Year Time Period	Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	kWh's Consumed By Stack	Log Hours of Rectifier Operation	Gallons of Product
1971								
June	151-183	757.5	637.0	637.1	628.2	628.6	4083	608.5
May	120-151	744	724.1	724.0	721.7	719.3	4725	724.0
April	90-120	720	619.5	619.5	614.4	614.0	4112	547.6
March	58-90	744	580.0	580.0	574.6	577.1	3683	536.9
Feb	31-58	672	367.9	367.8	323.3	328.7	2302	340.3
Jan	1-31	744	213.7	213.7	187.6	185.0	1155	159.2
1970								
Dec	334-365	744	92.6	92.3	89.7	86.9	536	51.8
Nov	304-334	720	127.6	127.6	127.2	122.8	660	105.0
Oct	273-304	744	270.6	303.0	295.3	294.4	1993	314.2
Sept	243-273	720	82.3	82.2	59.8	59.3	429	38.0
Aug	212-243	744	619.8	619.6	549.7	548.2	3870	537.7
July	181-212	744	-----	-----	-----	-----	4163	644.6
June	151-181	720	-----	-----	-----	-----	4379	652.7
May	120-151	744	-----	-----	-----	-----	3979	552.2
April	90-120	720	-----	-----	-----	-----	1731	322.6
March	71-90	456	-----	-----	-----	-----	1199	185.3
								97,808
								198,450
								593,762
								71,820
								1,016,329
								1,218,256
								1,233,527
								1,043,715
								609,676
								350,123

TABLE 30 ACTUAL MONTHLY ELECTROLYSIS COSTS AT SANTEE

costs in dollars							
Month	Sulfuric Acid @ \$0.039/lb	SHMP @ \$0.19/lb and Potable Water	Parts and Services For Repairs and Maintenance	Operation and Maintenance Manhour Costs With 30% Overhead	Cost of kWh Consumed @ \$0.009/kWh	Total Cost Per Month	Cost Per 1000 Gallons of Product Water
1971							
June	150.55	5.75	136.95	581.52	70.20	934.97	0.813
May	135.82	6.60	94.21	544.83	79.44	880.90	0.640
April	135.31	5.54	0.00	464.00	61.14	673.99	0.651
Mar	110.50	4.94	307.28	639.89	63.47	1076.00	1.06
Feb	87.28	3.66	229.10	556.48	42.26	838.78	---
Jan	40.87	2.31	123.43	676.08	26.45	869.14	---
1970							
Dec	0.00	0.66	156.68	609.78	12.20	779.32	---
Nov	7.49	1.06	25.62	330.38	13.52	378.07	---
Oct	22.25	2.78	68.84	540.97	35.53	670.37	---
Sept	0.00	0.46	0.00	494.33	11.04	505.83	---
Aug	117.95	4.58	294.65	963.38	67.40	1447.96	1.43
July	97.49	5.56	98.03	754.62	71.49	1027.91	0.844
June	49.17	5.76	87.62	601.58	73.28	817.41	0.663
May	73.73	4.14	78.00	528.11	64.28	748.26	0.717
April	54.08	2.82	0.00	362.87	32.69	452.46	0.742

est usage rate available by San Diego Gas & Electric Company. Operational and maintenance man-hour costs include foremen and administration from Table 26. Overhead is calculated as 30% of the total man-hours. This includes direct fringe benefits and office payroll services, plant vehicles, and other indirect overhead charges. Costs per thousand gallons product water were calculated only for the months near full operation so that comparable values could be obtained.

CONSTRUCTION COST

The contractor's construction bid of October 1968 are given in Table 31. The total of \$82,094 is updated to a February 1972 price of \$108,635. This was done by using a Los Angeles index of 133 for October 1968 and 176 for February 1972. This amount is amortized over twenty years at 6 percent annual interest.

ESTIMATED COST FOR A 50,000 GPD ELECTRODIALYSIS PLANT

The total cost of a 50,000 gpd electrodialysis plant at Santee under normal operating conditions is estimated at \$1.04 per thousand gallons. Operating costs are \$0.52 per thousand gallons and amortized construction costs are \$0.52 per thousand gallons. The estimated cost for man power, electricity, consumables, miscellaneous, and amortization are enumerated in Table 32.

MAN POWER

Operations and Maintenance

At least an Operator II should be responsible for the daily observations and maintenance of a 50,000 gpd Electrodialysis unit. This operator would have other duties in the sewage plant, but his first responsibility would be for the electrodialysis plant. It is also important that the operator or operators would be permanently assigned to the unit. It takes some time for an employee to become proficient and confident enough to maintain the unit under long term conditions. Troubleshooting the electrode/signal transmitter/pneumatic converter-transmitter network is quite difficult at times, and demands a skill in "puzzle solving" and an awareness gained only through experience with equipment of this type.

Ideally, an Operator II would work with a Mechanic II who would have electrical and instrumentation background. The Mechanic II would handle all preventive maintenance and would be responsible for organizing work crews when needed. He would also be a regular plant employee whose first duty would be the electrodialysis plant.

Evening and Night Shifts

By the end of the project, each evening, night, and weekend duty man was checking the unit at least twice a shift. It was found that the

TABLE 31 CONSTRUCTION COST FOR THE ELECTRODIALYSIS PLANT

Earthwork	\$ 800
Reinforced Concrete pad for the electrodialysis building with surrounding sidewalks	1,600
Piping supply and waste lines for the electrodialysis skid	1,429
Mechanical Equipment skid mounted electrodialysis unit with pumps and internal piping, post carbon adsorption water storage tank	64,575
Prefabricated Building	6,424
Painting	300
Electrical	2,000
Inspection (est)	1,795
Engineering (est)	3,106
Corrected Drawings	65
TOTAL CONSTRUCTION COST	\$82,094

TABLE 32 COST ESTIMATE FOR A 50,000 GPD ELECTRODIALYSIS PLANT

	Amount	Unit Price \$	\$/1000 gal.
Operational Supervisor	4.0 hrs/mo	5.50/hr	
Operator II			
Daily Observation	18.0 hrs/mo	4.25/hr	
Chemical Preparation	8.0 hrs/mo	4.25/hr	
Flushes & Shut Downs	13.0 hrs/mo	4.25/hr	
Maintenance (Mech II)	16.0 hrs/mo	4.25/hr	
Evening Shift			
Operator III or IV	10.0 hrs/mo	3.50/hr	
Night Shift			
Operator III or IV	7.0 hrs/mo	3.50/hr	
Weekend Shift			
Operator III or IV	3.0 hrs/mo	3.50/hr	
Total Labor			0.238
Overhead		40%	0.095
Electricity			
Lights, Pumps, & Rectifier	8826.1 kWh/mo	0.009/kWh	0.058
Chemicals			
Sulfuric Acid	3580.7 lb/mo	0.041/lb	0.107
Sodium Hexametaphos- phate	1 lb/day	0.19/lb	0.004
Membranes	9/15 mo	27.00/mo	0.020
Filters	30/15 mo	3.42/mo	0.002
Operating Cost			0.524
Amortization	\$108,635	20 yrs @6%	0.515
Total Cost			1.039

length of time spent checking the unit decreased as each man became familiar with the expected magnitudes and the locations of the plant readings. Here again, in order to avoid constant training, regular permanent employees should be assigned to the unit.

Monitoring would eventually be eliminated to one time per shift. This is reasonable only with men experienced with the unit. This would cut the evening, night, and weekend shift time spent on the unit by 1/3 to 1/2 their present values. Shift man-hours are calculated on this basis in Table 32. The evening shift would be seven days per week and the night shift, five days per week.

PREVENTIVE MAINTENANCE

Preventive maintenance is an important contingency in the cost estimate of Table 32. It is felt that with a rigid, preventive maintenance program, the high monthly man-hours and parts cost experienced in the first year and one-half could be eliminated. This program would have to be developed as experience was gained by the Operator II and the Mechanic II. It would be coordinated and, most importantly, enforced by the Operational Supervisor or Plant Superintendent.

Before such a program could be initiated at Santee, two important equipment changes would have to be made. First, it is recommended if possible, that the sulfuric acid pump be replaced with a unit which separates the diaphragm head from the pump mechanism. With this type of pump, there would be no fears of an unexpected diaphragm failure allowing sulfuric acid into the pump mechanism. Second, the present dehumidifier in the air system would be replaced with one which has an automatic "blow down" for discharging the extracted water. Excess water and oil in the air system was the single most important cause of man-hours spent on the pH monitoring system.

CONSUMABLES

Sulfuric Acid

The operational costs at Santee could be lowered by purchasing sulfuric acid in 3,000 gallon lots. The installation at Santee has a 800 gallon acid storage tank. At this quantity, sulfuric acid is \$55.35/ton with a freight charge, from Los Angeles, of \$158.00. The same company would ship 3,000 gallons of acid from Los Angeles to Santee at \$34.50/ton with a freight charge of \$168.00. There is almost identical freight costs for taking the tank truck between the two cities. The total amount paid per pound of concentrated acid would be 2.1 cents for the 3000 gallon lot as compared to 4.1 cents for the 800 gallon lot.

If a new tank was purchased for the unit, the installed price would be approximately \$3,000 (at \$1.00/gallon). If amortized along with the construction costs, an increase of \$0.0142 in Table 32 could be

expected. The net savings would be 0.6 cents per pound of acid used, or about \$25.00 per month. This would lower the costs per thousand gallons of product water from \$1.04 to \$1.00. Care should be taken, when designing an electrodialysis plant, as to its individual location and the availability of the required consummables. Properly sized chemical storage facilities should then be supplied with the unit.

Sodium Hexametaphosphate

The savings in man-hours associated with changing from the powdered to the flakes form of SHMP has been discussed in the Man-Hour Section of this chapter. There is no difference between the price of the two (19 cents per pound).

COST ESTIMATES FOR A 1.5 MGD ELECTRODIALYSIS PLANT

A current cost estimate for a 1.5 MGD plant, based on Ionics Inc. data (20), is given in Table 33. The estimate is for a plant which would contain two membrane stacks, and would reduce the average carbon adsorption effluent of 1245 mg/l total dissolved solids (TDS) to 500 mg/l TDS. The plant would lose approximately 15 percent of its influent water as waste brine, and would use no sodium hexametaphosphate (SHMP). The total 28.6 cents/1000 gallons of product does not include the cost of carbon adsorption treatment.

An Ionics estimate based on their reversing system is included in Table 34. This system reverses the DC current direction and the flow path of the diluting and concentrating streams every 15 minutes. The electrodes reverse by switching the polarity of the cathodes and the anodes. This is controlled by a set of relays and timers. The stream flow paths also exchange their source every 15 minutes. Motor operated valves controlled by the timers, switch the streams so that the flow path that was previously the diluting stream becomes the concentrating stream, and the flow path that was previously the concentrating stream becomes the diluting stream.

The cost adjustments for the above plant include higher electrical power usage, less product water, and the elimination of chemical and related hardware costs. The electrical power of the rectifier and pumps is increased by 15 percent. The amount of water going to waste increases into the range of 15 to 25 percent. A value of 20 percent is used in the Santee estimates. Finally, all usage of chemicals, sulfuric acid, and SHMP is eliminated. This means the elimination of all the related pumps and electronic-pneumatic control systems. It is felt that this system would have greatly reduced the manpower and maintenance values at Santee.

**TABLE 33. COST ESTIMATE FOR A 1.5 MGD ELECTRODIALYSIS PLANT USING
CHEMICAL ADJUSTMENT**

Item	Amount	Unit Price \$	\$/1000 gal.
Operating and Maintenance Labor - Operator II	two men @ 1.5 man-yr/yr	8874/yr	0.016
Administration and Overhead		40%	0.007
Electrical Power			
Rectifier - at 80% Efficiency	2.98kWh/1000 gal.	0.009/kWh	0.027
Pumping Power	2.00kWh/1000 gal.	0.009/kWh	0.018
Chemicals			
Sulfuric Acid	2 lb/1000 gal.	0.021/lb	0.042
Maintenance			
Membranes			0.050
Filters			0.020
Other Parts			0.010
Water Wastes (15%)			0.045
Amortization \$420,000	25 yrs @ 6%		0.053
Total			0.286

TABLE 34. COST ESTIMATE FOR A 1.5 MGD ELECTRODIALYSIS PLANT USING REVERSAL OF CURRENT AND FLOWS.

Item	Amount	Unit Price \$	\$/1000 gal.
Operating Labor Operator II	1.5 man-yr/yr	8874/yr	0.016
Administration and Overhead		40%	0.007
Electrical Power Rectifier at 80% Efficiency	3.43 kWh/1000 gal.	0.009/kWh	0.031
Pumping Power	2.30 kWh/1000 gal.	0.009/kWh	0.021
Maintenance			0.080
Waste Water (20%)			0.060
Amortization \$420,000	25 yrs @ 6%		0.053
Total			0.268

SECTION XI

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SECTION XIII

GLOSSARY

Adsorption - Adhesion in an extremely thin layer of molecules to the surfaces of solid bodies.

Anion - A negatively charged ion.

Anode - The positive terminal of an electrolytic cell.

Cathode - The negative terminal of an electrolytic cell.

Cation - A positively charged ion.

Current Density - Defined as the current in milliamperes divided by the effective membrane area.

Current Efficiency - The ratio of the chemical equivalents of salt actually removed per cell-pair to that theoretically possible at a particular current.

Ion - An atom or groups of atoms carrying a positive or negative electric charge as a result of having lost or gained one or more electrons.

Limiting Current Density - The current at which the effects of polarization become significant.

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APPENDIX A

TABLE A-1 SUMS FOR MICROMHOS/CM VERSUS STREAM NORMALITY LINEAR REGRESSION EQUATIONS

24 Data Points From May Through August, 1970					
	X milliequivalents/liter				
	Y micromhos/cm @ 25°C				
	equation: y 87.8x + 56.6				
sums	$\frac{N}{24}$	$\frac{X}{289.7}$	$\frac{Y}{26,814}$	$\frac{X^2}{4058.9}$	$\frac{XY}{373,103}$
67 Data Points From January Through June, 1971					
	X milliequivalents/liter				
	Y micromhos/cm @ 25°C				
	equation: Y 84.3x - 120.2				
sums	$\frac{N}{67}$	$\frac{X}{845.1}$	$\frac{Y}{78,732}$	$\frac{X^2}{13,119.9}$	$\frac{XY}{1,208,181}$

TABLE A-2 LOGARITHMIC RESISTANCES FOR DILUTING AND CONCENTRATING STREAMS

1971 Date	Day	Time	First Stage		Second Stage	
			Diluting Stream ohm-cm	Concentrating Stream ohm-cm	Diluting Stream ohm-cm	Concentrating Stream ohm-cm
7-2	183	1340	888.2	284.6	1344.1	255.8
		0737	792.2	333.1	1028.6	269.2
7-1	182	1500	743.8	357.4	1091.8	387.4
		0720	737.9	213.8	1066.6	195.2
6-30	181	1312	778.1	200.3	1230.9	182.3
		0735	712.9	207.2	1096.0	188.1
6-29	180	1430	603.6	177.0	893.2	161.2
6-28	179	1430	721.8	178.3	1076.1	164.3
		0930	718.1	212.2	1126.3	191.6
6-25	176	0707	668.6	237.3	853.2	219.7
6-24	175	1520	746.1	237.5	1075.7	216.0
		1000	726.3	269.1	956.8	246.8
		0732	680.3	267.3	843.7	248.3
6-23	174	1530	677.2	276.7	884.3	238.9
		0705	530.6	234.3	973.5	216.7
6-22	173	1515	712.8	245.5	984.1	225.6
		0710	639.5	239.1	814.6	221.7
6-21	172	1500	641.4	248.1	920.1	227.6
		0715	624.2	266.4	746.5	249.0
6-18	169	1500	699.5	260.0	956.6	236.2
		0835	623.8	227.8	881.9	207.3
6-17	168	1250	665.8	226.3	884.6	208.9
		0720	686.9	234.2	941.5	214.5
6-16	167	1500	724.0	205.3	1105.5	191.8
		0710	703.4	243.6	1038.3	218.7
6-15	166	1500	735.8	297.8	1077.2	263.5
		0710	690.0	245.4	1027.4	220.7
6-14	165	1510	713.6	211.0	1095.9	186.9
		1330	692.8	226.3	1088.8	201.6
6-11	162	1500	692.9	222.6	1023.5	202.3
		0702	695.6	221.2	999.7	201.2
6-9	160	1500	657.1	213.3	971.3	192.3
		0706	643.0	201.2	940.7	182.8
6-8	159	1515	765.0	219.5	1194.5	198.5
		0743	643.6	207.4	913.6	188.1
6-7	158	1530	721.4	220.0	1038.3	205.7
		0708	676.0	220.7	967.1	210.7

TABLE A-2 LOGARITHMIC RESISTANCES FOR DILUTING AND CONCENTRATING STREAMS (CONTINUED)

1971 Date	Day	Time	First Stage		Second Stage	
			Diluting Stream ohm-cm	Concentrating Stream ohm-cm	Diluting Stream ohm-cm	Concentrating Stream ohm-cm
6-4	155	1500	711.4	203.1	1095.9	184.1
		0705	649.5	233.3	881.0	212.4
6-3	154	1520	679.1	225.7	948.7	206.0
		1000	647.2	239.1	864.8	218.6
		0700	667.5	225.5	941.8	205.3
6-2	153	1517	617.6	227.3	881.0	207.8
		0747	641.1	228.5	870.0	208.8
6-1	152	1511	644.8	205.6	972.5	189.8
		0724	611.4	251.3	820.4	210.2
5-28	148	1450	700.5	235.5	1080.1	211.2
		0745	686.9	232.9	966.0	211.6
5-27	147	1500	708.9	223.6	1005.3	207.4
		0745	665.5	220.6	963.0	199.6
5-26	146	1430	705.5	215.6	1044.5	195.7
		0823	616.9	213.3	1038.3	193.4
5-25	145	1435	700.5	206.3	1100.6	186.2
		0820	674.0	219.1	963.5	199.2
5-24	144	1447	679.4	228.0	997.9	207.4
		1100	679.9	229.0	967.6	208.1
5-21	141	1315	688.7	211.6	1049.2	191.3
		0705	624.1	208.4	863.2	190.5
5-20	140	1615	701.8	224.3	1062.1	201.8
		1230	655.8	210.0	970.2	189.3
		0705	674.0	209.4	983.3	190.5
5-18	138	0720	658.0	217.4	893.8	199.3
5-17	137	1430	630.8	214.4	864.0	196.6
		0745	670.7	222.3	919.2	204.2
5-14	134	0720	626.3	211.2	837.7	194.3
5-12	132	1440	683.9	219.8	955.9	212.3
		0730	658.6	182.7	932.6	192.4
5-11	131	1515	668.7	219.2	993.7	198.0
		0710	630.7	229.6	822.8	211.5
5-10	130	1541	649.7	239.6	877.3	218.6
		0805	615.5	248.7	815.9	209.1
5-7	127	1430	674.1	225.1	949.9	205.2
		0700	658.7	202.6	926.4	185.8

TABLE A-2 LOGARITHMIC RESISTANCES FOR DILUTING AND CONCENTRATING STREAMS (CONTINUED)

1971 Date	Day	Time	First Stage		Second Stage	
			Diluting Stream ohm-cm	Concentrating Stream ohm-cm	Diluting Stream ohm-cm	Concentrating Stream ohm-cm
5-4	124	1440	694.8	212.4	945.3	196.0
		0730	701.1	211.1	966.6	194.7
5-3	123	1515	725.8	219.9	1054.9	200.4
4-30	120	0900	656.3	225.2	899.7	206.9
4-29	119	0920	652.1	208.4	885.6	192.1
4-28	118	0750	662.4	220.5	952.2	199.9
4-22	112	1545	660.9	216.1	919.7	198.0
		0830	655.4	246.5	893.8	223.9
4-21	111	0744	679.5	246.8	923.8	224.7
4-20	110	1330	684.4	217.7	971.5	206.3
		0730	644.3	220.1	882.7	211.1
4-19	109	0705	611.8	228.5	805.6	209.7
4-17	107	1600	699.6	241.7	985.9	219.6
		1200	692.3	244.0	997.4	219.3
		1030	656.6	235.0	859.7	216.5
4-16	106	0715	642.2	270.3	889.5	242.2
4-15	105	1145	722.7	220.9	1095.6	199.5
		0745	692.2	242.7	914.2	223.7
4-14	104	1130	674.5	235.2	930.3	214.6
		0745	653.7	225.8	913.7	205.5
4-13	103	0730	669.7	218.2	929.0	199.8
4-12	102	0900	684.4	204.8	1001.3	191.4
		0730	678.6	228.3	960.1	207.2
4-9	99	1500	721.9	212.4	1126.4	195.7
		0700	642.0	223.0	884.6	203.6
4-8	98	0815	630.4	210.5	901.1	191.1
4-7	97	1415	677.2	214.9	976.8	195.5
4-6	96	1140	701.8	197.8	1030.7	181.4
		0900	635.8	223.2	938.2	200.0
4-5	95	1315	675.0	207.7	993.2	188.7
		0800	654.5	171.4	966.0	158.0
4-3	93	1435	705.3	223.6	116.4	199.2
		1030	672.7	202.0	968.6	184.7
4-2	92	1600	735.5	210.1	1123.3	191.0
		0920	669.9	214.0	939.9	195.3

TABLE A-2 LOGARITHMIC RESISTANCES FOR DILUTING AND CONCENTRATING STREAMS (CONTINUED)

1971 Date	Day	Time	First Stage		Second Stage	
			Diluting Stream ohm-cm	Concentrating Stream ohm-cm	Diluting Stream ohm-cm	Concentrating Stream ohm-cm
3-31	90	0950	660.7	217.1	978.7	196.8
3-30	89	0820	632.8	219.6	877.4	200.0
3-29	88	1350	693.3	219.6	972.6	201.1
		1024	657.7	227.6	892.9	208.6
		0830	655.0	230.2	1074.9	210.8
3-26	85	1500	691.3	220.6	1024.5	191.6
		1130	678.5	207.8	1006.8	188.8
		0735	648.0	197.6	887.1	202.6
3-25	84	1430	679.0	216.5	1002.0	196.1
		1139	641.3	230.5	899.5	208.6
		0740	632.2	221.2	864.2	196.7
3-24	83	0815	645.1	210.8	917.6	191.8
3-23	82	1330	651.5	204.9	961.9	186.2
		0815	617.9	224.1	827.1	205.0
3-22	81	0830	543.3	223.0	800.3	203.9
3-20	79	0910	641.0	210.3	889.6	192.5
3-19	78	1430	659.6	226.2	969.3	203.4
		0820	652.8	200.1	970.0	181.4
3-18	77	1100	663.4	209.0	964.9	189.6
		0720	630.3	217.0	867.4	198.7
3-17	76	1445	648.9	210.8	912.3	192.6
		0720	635.4	211.2	886.9	192.8
3-16	75	0735	625.8	217.7	867.4	198.2
3-15	74	1420	672.3	214.8	973.4	195.3
		0720	617.4	208.8	854.0	201.4
3-12	71	1400	208.0	207.3	1073.9	188.1
3-3	62	0910	679.3	221.4	983.6	200.9
3-2	61	1420	694.7	216.6	1040.1	196.0
3-1	60	1240	703.5	215.7	1080.0	194.5

TABLE A-2 LOGARITHMIC RESISTANCES FOR DILUTING AND CONCENTRATING STREAMS (CONTINUED)

1971 Date	Day	Time	First Stage		Second Stage	
			Diluting Stream ohm-cm	Concentrating Stream ohm-cm	Diluting Stream ohm-cm	Concentrating Stream ohm-cm
2-26	57	1520	715.7	212.2	1140.7	190.8
		0815	674.7	224.4	1034.0	200.8
2-25	56	1355	747.1	217.8	1120.5	198.6
2-22	53	1300	668.6	209.4	985.0	188.8
2-19	50	1500	705.7	216.8	1078.3	196.1
		1020	704.4	217.4	1090.2	195.6
		0800	673.8	210.9	978.2	191.9
2-18	49	1450	682.0	206.8	1014.7	187.8
		0800	667.6	205.0	974.5	187.5
2-17	48	1500	723.2	290.2	1120.8	252.7
2-11	42	0800	711.9	223.3	1018.8	203.6
2-10	41	1720	753.9	218.0	1164.5	197.5
2-9	40	0830	673.1	231.7	876.5	211.1
2-8	39	1140	716.1	216.5	1075.4	196.4
		0825	662.5	245.9	881.0	225.2
2-6	37	1700	717.3	255.8	1097.3	227.9
2-5	36	1415	675.5	226.0	911.5	208.2
		0810	692.0	213.9	972.9	196.5
2-4		1520	791.7	208.6	1188.8	191.5
		0800	782.9	214.2	1129.1	197.6
2-3	34	1900	731.3	198.2	1129.7	180.4
		1750	684.5	214.6	1060.0	193.6
1-29	29	1430	690.7	216.0	911.5	201.1
		0802	672.7	219.2	923.3	201.5
1-28	28	1745	731.1	219.1	1058.4	199.7
		0836	710.6	221.0	1030.2	201.1
1-27	27	1550	707.8	220.2	1094.2	199.2
1-15	15	0830	644.8	216.2	904.5	197.1
1-14	14	1530	597.3	199.6	858.6	181.1
		0815	656.2	210.4	920.4	192.7
1-13	13	1410	677.2	209.7	1015.2	189.8
		0855	673.7	208.9	994.1	189.1
1-12	12	1600	650.2	211.3	1007.7	189.1
1-7	7	0800	727.9	212.7	1170.3	191.0

TABLE A-2 LOGARITHMIC RESISTANCES FOR DILUTING AND CONCENTRATING STREAMS (CONTINUED)

1970 Date	Day	Time	First Stage		Second Stage	
			Diluting Stream ohm-cm	Concentrating Stream ohm-cm	Diluting Stream ohm-cm	Concentrating Stream ohm-cm
12-18	352	1500	789.5	259.7	1146.1	235.0
		1300	758.3	226.8	1133.6	206.0
		0720	737.2	226.2	1101.2	205.0
12-17	351	1500	788.0	208.4	1262.1	189.0
		1330	751.2	203.6	1235.4	183.3
		1030	724.1	205.9	1158.7	185.7
12-16	350	0730	745.9	228.2	1078.2	204.2
12-15	349	1515	774.4	225.0	1188.3	204.0
12-14	348	1030	793.3	207.2	1291.1	187.6
12-10	344	1145	807.1	257.5	1271.8	229.9
12-9	343	1300	852.3	248.8	1415.5	221.0
		1000	796.8	241.1	1222.0	217.6
11-4	308	1000	713.3	232.5	1005.3	212.2
11-2	306	1530	774.4	236.1	1188.3	213.0
		0730	693.3	224.7	965.8	205.5
10-30	303	1530	778.1	210.3	1258.0	190.3
10-29	302	1000	795.5	214.8	1257.9	194.3
10-28	301	1530	824.7	214.1	1412.4	193.0
10-27	300	1500	782.8	244.7	1291.1	217.1
10-26	299	1000	784.4	211.3	1255.5	197.8
10-20	293	0830	783.3	223.8	1253.3	201.5
10-16	289	1000	774.6	242.1	1112.1	220.9
10-15	288	1000	761.7	228.0	1117.6	207.8
10-14	287	1000	744.1	251.6	1161.1	222.7
10-13	286	1130	783.3	216.8	1230.9	196.2
10-1	274	0835	704.7	225.5	1054.1	203.4

TABLE A-2 LOGARITHMIC RESISTANCES FOR DILUTING AND CONCENTRATING STREAMS (CONTINUED)

1970 Date	Day	Time	First Stage		Second Stage	
			Diluting Stream ohm-cm	Concentrating Stream ohm-cm	Diluting Stream ohm-cm	Concentrating Stream ohm-cm
8-28	240	0800	777.1	204.9	1172.3	188.0
8-27	239	1500	819.6	223.0	1278.8	202.6
		1200	819.6	239.1	1289.4	216.0
		0800	807.0	226.9	1234.2	206.4
9-26	238	1440	836.6	210.7	1271.8	193.9
8-24	236	1530	805.3	244.7	1288.5	218.9
		1230	796.0	210.5	1242.1	192.0
		0900	778.8	216.9	1217.8	196.7
8-21	233	0800	718.8	211.6	1088.8	192.1
8-20	232	1500	836.5	307.5	1288.3	217.4
		1200	809.2	222.0	1192.6	203.7
		0800	767.9	207.4	1158.2	189.1
8-19	231	1200	747.4	202.1	1144.1	185.1
		0900	745.2	214.0	1120.8	194.9
8-18	230	1500	823.5	245.2	1315.7	220.2
		1200	796.8	219.3	1248.7	194.2
		0800	820.7	221.8	1246.0	202.6
8-17	229	1500	870.4	235.6	1395.4	213.2
		1300	857.3	196.8	1359.9	181.2
		0900	825.5	239.6	1260.0	217.1
8-14	226	1500	821.6	217.7	1323.2	197.2
		0800	779.8	215.5	1224.3	195.4
8-13	225	1530	855.5	240.6	1414.6	212.2
		0800	811.4	236.6	1305.5	212.2
8-12	224	1500	814.9	226.5	1315.7	204.5
		1200	808.0	230.7	1287.6	208.3
		0800	785.1	223.2	1233.0	202.0
8-11	223	1500	831.6	231.0	1341.3	208.4
		1300	833.6	223.0	1334.6	209.1
		0800	806.4	265.9	1217.8	239.1
8-10	222	1500	786.0	264.1	1248.7	234.2
		1300	773.6	265.7	1182.3	237.1
		0800	777.2	265.8	1215.6	235.7
8-7	219	1200	754.9	244.6	1168.2	219.0

TABLE A-3 CALCULATED CELL PAIR MEMBRANE RESISTANCES UNCORRECTED AND CORRECTED

1971 Date	Day	Time	M e m b r a n e R e s i s t a n c e			
			Uncorrected		Corrected to 21.7°C and 1425 micromhos/cm	
			First Stage ohm-cm ²	Second Stage ohm-cm ²	First Stage ohm-cm ²	Second Stage ohm-cm ²
7-2	183	1340	88.0	212.1	39.6	42.3
		0737	176.2	252.6	124.8	261.3
7-1	182	1500	137.0	215.1	127.8	193.1
		0720	145.2	246.5	132.2	223.7
6-30	181	1312	103.5	204.7	85.7	97.3
		0735	103.6	213.7	105.2	173.2
6-29	180	1430	76.5	177.5	136.6	318.7
6-28	179	1430	103.9	195.7	110.7	186.0
		0930	83.3	165.1	82.8	119.0
6-25	176	0707	235.4	280.5	273.7	477.6
6-24	175	1520	153.4	268.8	147.1	256.6
		1000	208.0	294.6	215.0	309.5
		0732	282.5	337.5	328.1	617.4
6-23	174	1530	179.6	275.4	230.7	487.7
		0705	247.0	307.8	314.2	381.6
6-22	173	1515	183.1	266.6	211.5	361.6
		0710	238.2	294.7	310.6	560.7
6-21	172	1500	223.6	262.9	282.2	435.4
		0715	338.8	315.8	445.9	693.7
6-18	169	1500	209.2	239.8	245.4	285.9
		0835	193.4	221.9	255.0	331.8
6-17	168	1250	200.2	263.6	257.9	447.9
		0720	188.4	267.0	193.6	333.8
6-16	167	1500	134.7	247.7	142.3	210.9
		0710	184.2	247.9	176.8	226.4
6-15	166	1500	138.4	259.9	118.3	256.2
		0710	164.6	267.9	175.2	265.9
6-14	165	1510	126.6	230.6	139.8	204.2
		1330	125.9	221.3	151.6	200.8
6-11	162	1500	135.1	219.7	135.3	211.0
		0702	154.5	222.2	153.2	230.9
6-9	160	1500	146.2	234.2	169.3	267.3
		0706	136.3	207.6	166.7	260.2
6-8	159	1515	133.7	258.5	107.8	137.1
		0743	157.0	220.7	191.7	301.4
6-7	158	1530	169.6	248.3	166.0	248.5
		0708	163.1	233.7	174.9	269.9

TABLE A-3 CALCULATED CELL PAIR MEMBRANE RESISTANCES UNCORRECTED AND CORRECTED (CONTINUED)

1971 Date	Day	Time	M e m b r a n e R e s i s t a n c e			
			Uncorrected		Corrected to 21.7°C and 1425 micromhos/cm	
			First Stage ohm-cm ²	Second Stage ohm-cm ²	First Stage ohm-cm ²	Second Stage ohm-cm ²
6-4	155	1500	122.3	226.6	125.0	183.6
		0705	209.8	254.3	237.8	362.8
6-3	154	1520	182.4	235.1	193.2	287.6
		1000	173.1	242.3	176.8	325.6
		0700	220.8	267.9	208.0	286.6
6-2	153	1517	206.2	250.4	247.8	375.7
		0747	195.5	242.8	216.7	339.3
6-1	152	1511	149.6	218.3	181.8	247.6
		0724	229.0	243.5	284.8	392.8
5-28	148	1450	145.3	263.5	127.0	187.4
		0745	197.0	280.4	181.9	293.5
5-27	147	1500	183.5	271.5	172.1	277.5
		0745	171.4	247.3	182.3	275.1
5-26	146	1430	158.1	235.0	157.8	219.9
		0823	149.4	227.2	147.3	207.4
5-25	145	1435	125.3	230.2	134.1	184.0
		0820	167.8	234.3	181.7	273.8
5-24	144	1447	171.0	267.0	183.8	306.0
		1100	172.6	232.9	191.6	281.9
5-21	141	1315	126.1	230.6	122.0	193.0
		0705	181.9	237.1	227.3	356.8
5-20	140	1615	184.1	224.0	195.8	206.6
		1230	152.9	214.8	186.9	210.9
		0705	178.8	233.1	183.8	243.4
5-18	138	0720	189.3	249.9	200.2	343.6
5-17	137	1430	185.2	257.7	261.6	444.5
		0745	175.7	238.2	192.7	318.8
5-14	134	0720	184.8	239.3	241.4	406.7
5-12	132	1440	167.8	233.7	183.2	292.9
		0730	160.3	229.9	175.1	281.0
5-11	131	1515	131.1	239.9	152.1	266.3
		0710	212.1	264.9	258.7	446.7
5-10	130	1541	193.9	254.1	243.1	403.6
		0805	194.2	248.2	237.7	405.7
5-7	127	1430	166.6	248.1	180.4	302.5
		0700	149.1	227.2	154.2	268.6

TABLE A-3 CALCULATED CELL PAIR MEMBRANE RESISTANCES UNCORRECTED AND CORRECTED (CONTINUED)

1971 Date	Day	Time	M e m b r a n e R e s i s t a n c e			
			Uncorrected		Corrected to 21.7°C and 1425 micromhos/cm	
			First Stage ohm-cm ²	Second Stage ohm-cm ²	First Stage ohm-cm ²	Second Stage ohm-cm ²
5-4	124	1440	164.1	249.5	163.0	308.5
		0730	150.7	230.2	116.3	215.4
5-3	123	1515	138.5	232.8	120.9	200.6
4-30	120	0900	168.0	248.5	175.5	319.0
4-29	119	0920	168.8	238.7	159.2	285.0
4-28	118	0750	148.8	235.3	151.7	257.2
4-22	112	1545	160.6	238.8	183.1	318.8
		0830	171.5	238.8	179.7	311.7
4-21	111	0744	172.3	231.5	164.0	275.9
4-20	110	1330	154.8	250.3	152.5	271.1
		0730	185.9	263.6	202.2	355.4
4-19	109	0705	209.4	286.3	229.1	430.0
4-17	107	1600	158.6	252.2	138.8	247.7
		1200	134.8	228.8	125.0	222.8
		1030	202.1	275.1	210.8	396.4
4-16	106	0715	168.7	233.3	191.4	316.3
4-15	105	1145	129.3	233.8	114.4	173.4
		0745	197.7	268.8	188.7	347.8
4-14	104	1130	172.8	249.1	172.5	299.2
		0745	172.0	231.5	185.6	304.2
4-13	103	0730	153.9	246.3	156.6	296.6
4-12	102	0900	149.6	231.2	147.3	227.9
		0730	159.6	238.0	152.5	254.2
4-9	99	1500	119.1	218.1	110.9	150.3
		0700	171.8	250.4	179.2	318.2
4-8	98	0815	167.1	241.4	198.4	316.6
4-7	97	1415	154.3	237.5	163.8	266.2
4-6	96	1140	127.9	225.1	129.8	221.1
		0900	162.0	236.7	193.7	284.8
4-5	95	1315	145.4	232.3	172.7	270.6
		0800	156.5	242.4	164.6	257.8
4-3	93	1435	134.7	266.3	134.7	191.1
		1030	150.1	235.2	154.8	257.0
4-2	92	1600	130.4	227.4	114.7	158.5
		0920	173.4	237.0	176.4	276.5

TABLE A-3 CALCULATED CELL PAIR MEMBRANE RESISTANCES UNCORRECTED AND CORRECTED (CONTINUED)

1971 Date	Day	Time	M e m b r a n e R e s i s t a n c e			
			Uncorrected		Corrected to 21.7°C and 1425 micromhos/cm	
			First Stage ohm-cm ²	Second Stage ohm-cm ²	First Stage ohm-cm ²	Second Stage ohm-cm ²
3-31	90	0950	151.2	228.8	164.0	242.6
3-30	89	0820	154.9	223.1	177.2	305.7
3-29	88	1350	154.2	256.2	162.0	292.7
		1024	190.5	272.5	219.8	394.4
		0830	192.3	258.9	207.6	192.4
3-26	85	1500	136.4	241.9	137.1	231.5
		1130	140.4	239.5	149.2	243.1
		0735	180.5	254.7	200.1	347.7
3-25	84	1430	149.4	243.7	178.5	281.8
		1139	176.7	248.4	206.5	335.9
		0740	170.9	244.6	185.1	329.4
3-24	83	0815	169.6	239.7	185.1	291.5
3-23	82	1330	141.2	231.6	158.7	259.1
		0815	207.3	278.6	237.1	417.5
3-22	81	0830	195.0	263.4	245.3	426.2
3-20	79	0910	167.7	246.7	175.4	308.6
3-19	78	1430	142.3	225.0	163.0	258.3
		0820	134.6	227.2	126.4	210.1
3-18	77	1100	150.3	235.1	156.8	253.9
		0720	178.2	252.7	192.1	337.3
3-17	76	1445	172.6	240.1	195.9	312.2
		0720	169.5	242.7	170.5	289.2
3-16	75	0735	175.4	235.9	183.2	297.2
3-15	74	1420	155.2	225.4	160.4	242.7
		0720	189.8	241.0	204.8	315.6
3-12	71	1400	129.6	224.2	112.6	167.9
3-3	62	0910	168.1	279.7	133.0	233.1
3-2	61	1420	148.9	239.8	125.8	186.2
3-1	60	1240	148.5	245.2	121.0	165.1

TABLE A-3 CALCULATED CELL PAIR MEMBRANE RESISTANCES UNCORRECTED AND CORRECTED (CONTINUED)

1971 Date	Day	Time	M e m b r a n e R e s i s t a n c e			
			Uncorrected		Corrected to 21.7°C and 1425 micromhos/cm	
			First Stage ohm-cm ²	Second Stage ohm-cm ²	First Stage ohm-cm ²	Second Stage ohm-cm ²
2-26	57	1520	137.6	217.1	106.3	113.3
		0815	153.6	240.0	132.2	176.7
2-25	56	1355	145.8	240.7	104.3	146.4
2-22	53	1300	137.2	237.4	125.0	215.2
2-19	50	1500	136.7	236.0	103.7	150.6
		1020	134.1	226.0	102.2	138.1
		0800	164.3	242.1	132.9	204.8
2-18	49	1450	---	---	---	---
		0800	144.6	218.3	128.1	198.8
2-17	48	1500	134.5	221.4	100.7	127.2
2-11	42	0800	167.8	275.8	124.0	217.8
2-10	41	1720	144.8	261.6	100.2	131.9
2-9	40	0830	262.1	289.5	227.2	355.2
2-8	39	1140	161.5	250.3	124.7	171.5
		0825	237.9	252.7	214.9	306.0
2-6	37	1700	155.3	254.8	119.2	160.5
2-5	36	1415	210.4	234.4	191.8	274.7
		0810	185.9	233.6	139.7	201.3
2-4	35	1520	132.1	241.0	72.3	102.6
		0800	---	---	---	---
2-3	34	1100	126.6	241.6	88.7	130.1
		1750	131.7	233.6	112.4	164.2
1-29	29	1430	185.6	235.2	178.2	306.6
		0802	195.6	229.9	169.9	245.5
1-28	28	1745	160.1	277.7	122.8	213.8
		0836	139.3	264.4	103.4	200.8
1-27	27	1550	139.4	268.6	118.0	181.2
1-15	15	0830	221.6	267.6	180.8	257.6
1-14	14	1530	193.3	273.9	210.7	333.1
		0815	187.9	252.3	152.2	239.1
1-13	13	1410	153.3	238.6	130.7	190.4
		0855	153.8	240.8	124.4	193.8
1-12	12	1600	132.5	218.6	117.8	168.1
1-7	7	0800	158.6	251.2	81.8	84.3

TABLE A-3 CALCULATED CELL PAIR MEMBRANE RESISTANCES UNCORRECTED AND CORRECTED (CONTINUED)

1970 Date	Day	Time	M e m b r a n e R e s i s t a n c e			
			Uncorrected		Corrected to 21.7°C and 1425 micromhos/cm	
			First Stage ohm-cm ²	Second Stage ohm-cm ²	First Stage ohm-cm ²	Second Stage ohm-cm ²
12-18	353	1500	163.0	212.1	95.7	115.6
		1300	159.6	216.3	108.5	124.5
		0720	147.4	211.5	85.2	109.3
12-17	351	1500	123.9	222.6	69.0	63.0
		1330	123.0	216.8	86.2	76.5
		1030	119.5	199.8	94.4	103.4
12-16	350	0730	157.3	249.2	113.1	178.4
12-15	349	1515	143.4	258.5	85.2	100.8
12-14	348	1030	128.3	215.2	76.0	53.8
12-10	344	1145	155.0	226.9	87.9	67.0
12-9	343	1300	151.3	250.6	67.1	9.0
		1000	148.7	248.4	88.7	99.1
11-4	308	1000	180.1	195.6	182.5	226.4
11-2	306	1530	130.6	186.5	105.4	106.9
		0730	180.7	209.9	180.6	243.2
10-30	303	1530	115.3	174.6	91.4	68.1
10-29	302	1000	121.2	185.0	80.6	66.8
10-28	301	1530	94.2	173.3	59.2	8.8
10-27	300	1500	95.3	161.8	74.0	49.9
10-26	299	1000	91.6	181.2	61.3	62.4
10-20	293	0830	141.1	226.9	109.3	91.2
10-16	289	1000	148.0	223.8	119.4	177.5
10-15	288	1000	152.0	226.3	130.3	176.4
10-14	287	1000	138.4	232.5	128.3	150.5
10-13	286	1130	111.4	216.0	90.1	102.7
10-1	274	0835	108.3	204.8	119.1	202.0

TABLE A-3 CALCULATED CELL PAIR MEMBRANE RESISTANCES UNCORRECTED AND CORRECTED (CONTINUED)

1970 Date	Day	Time	M e m b r a n e R e s i s t a n c e			
			Uncorrected		Corrected to 21.7°C and 1425 micromhos/cm	
			First Stage ohm-cm ²	Second Stage ohm-cm ²	First Stage ohm-cm ²	Second Stage ohm-cm ²
8-28	240	0800	129.3	206.0	112.2	137.6
8-27	239	1500	121.8	201.9	95.8	82.9
		1200	115.0	199.4	87.2	73.6
		0800	120.1	208.9	93.5	105.5
8-26	238	1440	110.7	195.3	79.3	83.9
8-24	236	1530	106.8	183.2	90.5	70.1
		1230	111.2	179.6	95.0	90.0
		0900	112.2	178.0	100.4	98.5
8-21	233	0800	117.8	175.0	138.0	171.3
8-20	232	1500	122.3	199.4	84.8	73.6
		1200	120.7	198.4	96.7	129.2
		0800	119.2	184.9	134.6	136.4
8-19	231	1200	111.8	176.5	120.1	143.9
		0900	120.1	171.5	125.5	148.3
8-18	230	1500	118.7	196.3	91.4	60.2
		1200	123.5	197.6	105.2	95.4
		0800	118.7	189.2	86.3	89.7
8-17	229	1500	102.3	189.0	60.2	19.7
		1300	105.2	187.6	64.5	34.2
		0900	108.2	190.2	76.4	82.7
8-14	226	1500	111.5	197.9	86.7	57.0
		0800	115.9	188.3	103.8	100.9
8-13	225	1530	104.5	187.1	67.3	10.7
		0800	122.6	182.8	93.3	56.8
8-12	224	1500	106.5	185.8	85.8	57.0
		1200	106.8	176.9	86.1	66.1
		0800	119.6	186.8	103.9	95.1
8-11	223	1500	109.1	186.7	77.7	43.4
		1300	107.3	183.4	62.3	45.1
		0800	111.8	184.6	87.3	102.1
8-10	222	1500	104.4	167.6	97.2	83.8
		1300	105.5	170.7	100.6	117.2
		0800	105.7	170.8	91.7	92.4
8-7	219	1200	101.8	170.6	105.8	125.1

APPENDIX B

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PPESSURES AND FLOWS,
PART 1

1971	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
7-2	183	1340	54.0	31.5	18.8	1.6
		1320	Unit start-up			
		0930	Acid flushed the membrane stack			
		0737	54.0	31.5	19.0	1.6
7-1	182	1500	53.0	31.5	17.9	1.8
		0720	54.0	31.5	17.8	1.8
6-30	181	1312	Started sand filter influent			
		1312	54.0	31.5	16.5	1.8
		0735	54.0	31.5	16.0	1.7
6-29	180	1430	54.0	31.5	15.9	1.9
		1415	Unit start-up			
		1330	Unit shut-down			
		0715	53.8	31.5	15.8	1.8
6-28	179	1430	54.0	31.5	15.5	1.7
		0930	53.8	31.5	15.2	1.6
		0915	Unit start-up			
		0740	53.8	31.5	16.2	2.3
		0735	Hydraulics start-up			
6-25	176	1530	Unit shut-down			
		1525		31.5	17.0	2.3
		0710	Hand cleaned the membrane stack			
		0707		31.5	23.1	1.5
6-24	175	1520	54.0	31.5	23.5	1.7
		1500	Unit start-up			
		1435	Unit shut-down			
		1400	Acid flushed the membrane stack			
		1355	54.0	31.5	23.0	1.8
		1200		31.5	24.0	1.7
		1000	54.0	31.5	24.9	1.6
		0732	53.0	31.5	25.0	1.5
6-23	174	1530	52.0	31.5	24.8	1.5
		1445	Unit start-up			
		0930	Unit shut-down			
		0730	EDTA flushed the membrane stack			
		0705	54.0	31.5	24.9	1.4

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
6-22	173	1515	54.0	31.5	25.0	1.5
		1445	Unit start-up			
		1400	Unit shut-down			
		1300	Acid flushed the membrane stack			
		0710	54.0	31.5	24.8	1.4
6-21	172	1500		31.5	24.9	1.5
		1445	Unit start-up			
		1200	Unit shut-down			
		0930	Unit start-up			
		0830	Unit shut-down			
6-18	169	0730	Acid flushed the membrane stack			
		0715	54.0	31.5	24.9	1.4
		1500	54.0	31.5	24.7	1.5
		0835	54.0	31.5	24.2	1.5
		0750	Unit start-up			
6-17	168	1700	Unit shut-down			
		1250	54.0	31.5	24.7	1.5
		0720	54.0	31.5	24.5	1.4
6-16	167	1500	54.0	31.5	24.8	1.5
		1240	Unit start-up			
		0905	Unit shut-down			
		0805	Acid flushed the membrane stack			
		0710	56.0	26.5	22.5	1.3
6-15	166	1500	58.0	25.0	23.7	1.3
		1400	Unit start-up			
		1100	Unit shut-down			
		1000	Biz flushed the membrane stack			
		0710	52.0	30.0	23.9	1.4
6-14	165	1510		30.0	23.8	1.4
		1330		30.0	23.7	1.4
		1325	Unit start-up			
		1200	Unit shut-down			
		0930	Unit start-up			
6-13	164	0815	Unit shut-down			
		0715	Acid flushed the membrane stack			
		0700	Unit start-up			
		1800	Unit shut-down			

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	Feed Stream psig	Dilute Stream Influent gal./min	psig	Effluent psig
6-11	162	1500		31.5	24.2	1.4
		0736	Unit start-up			
		0713	Unit shut-down			
		0702	54.0	31.5	24.3	1.4
6-10	161	1430	54.0	31.5	24.3	1.4
		0805	54.0	31.5	24.2	1.4
6-9	160	1500	54.0	31.5	24.2	1.4
		0706	54.0	31.5	24.2	1.4
6-8	159	1515	54.0	31.5	24.2	1.4
		1022	Unit start-up			
		0922	Unit shut-down			
		0750	Acid flushed the membrane stack			
		0743	54.0	31.5	24.2	1.4
6-7	158	1530	54.0	31.5	24.2	1.4
		0708	54.0	31.5	24.0	1.4
6-4	155	1500		31.5	24.4	1.5
		1245	Unit start-up			
		0815	Unit shut-down			
		0715	Acid flushed the membrane stack			
		0705	54.0	31.5	24.3	1.4
6-4	154	1520	54.0	31.5	24.3	1.4
		1000	54.0	31.5	24.2	1.4
		0935	Unit start-up			
		0715	Unit shut-down			
		0700	54.0	31.5	24.1	1.4
6-2	153	1517	54.0	31.5	24.3	1.4
		0747	54.0	31.5	24.3	1.4
6-1	152	1511	54.0	31.5	24.3	1.4
		1120	Tightened the membrane stack			
		1115	Unit start-up			
		0900	Unit shut-down			
		0800	Acid flushed the membrane stack			
		0724	54.0	31.5	23.0	1.4
5-28	148	1450	54.0	31.5	22.9	1.4
		0800	Acid flushed the membrane stack			
		0745	54.0	31.5	22.8	1.4
5-27	147	1500	54.0	31.5	22.9	1.4
		0745	54.0	31.5	22.9	1.4

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	D i l u t e S t r e a m			
			Feed Stream psig	Influent gal./min	psig	Effluent psig
5-26	146	1430	54.0	31.5	23.2	1.4
		0823	54.0	31.5	22.9	1.4
5-25	145	1435	54.0	31.5	23.2	1.4
		1330	Unit start-up			
		1240	Hydraulic start-up			
		1000	Unit shut-down			
		0945	Acid flushed the membrane stack			
		0820	54.0	31.5	23.0	1.4
5-24	144	1447	54.0	31.5	23.2	1.3
		1100	54.0	31.5	23.0	1.3
5-21	141	1315	54.0	31.5	23.2	1.4
		1245	Unit start-up			
		1130	Hydraulic start-up			
		0830	Unit shut-down			
		0712	Acid flushed the membrane stack			
		0705	54.0	31.5	23.0	1.4
5-20	140	1615	54.0	31.5	23.5	1.4
		1230	54.0	31.5	23.5	1.4
		0945	Unit start-up			
		0915	Unit shut-down			
		0750	56.0	27.3	20.8	1.3
5-19	139	0740	54.0	30.2	22.2	1.3
5-18	138	2200	55.0	31.0	23.0	2.0
		1530	54.0	31.5	23.4	1.7
		1500	Unit start-up with one influent filter			
		1315	Acid flushed the membrane stack			
		0800	Biz flushed the membrane stack			
		0720	54.0	31.5	23.4	1.5
5-17	137	1430	54.0	31.5	23.8	1.5
		0745	54.0	31.5	23.6	1.5
5-14	134	1444		31.5	23.5	1.5
		1240	Unit start-up			
		0900	Acid flushed the membrane stack			
		0730	Unit shut-down			
		0720	54.0	31.5	23.8	1.5
5-13	133	1615	54.0	31.5	24.0	1.5
		0730		31.5	23.9	1.5
5-12	132	1440	54.0	31.5	23.8	1.5
		0730	54.0	31.5	23.8	1.5

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
5-11	131	1515	54.0	31.5	24.0	1.5
		1330	Unit start-up			
		0910	Unit shut-down			
		0745	Acid flushed the membrane stack			
		0710	54.0	31.5	23.8	1.5
5-10	130	1541	54.0	31.5	24.0	1.5
		0805	54.0	31.5	23.5	1.5
5-7	127	1430	54.0	31.5	23.8	1.5
		0700	54.0	31.5	23.3	1.5
5-6	126	1330	55.0	31.5	23.5	1.5
5-5	125	0745	55.0	31.5	23.5	1.6
5-4	124	1440	54.0	31.5	23.7	1.6
		0730	54.0	31.5	23.5	1.6
5-3	123	1515	54.0	31.5	23.5	1.6
4-30	120	1540	54.0	31.5	23.7	1.6
		1320	Unit start-up			
		1024	Acid flushed the membrane stack			
		0900	52.0	31.5	23.2	1.5
4-29	119	1500	54.0	31.5	23.5	1.5
		0920	52.5	31.5	23.1	1.4
4-28	118	0750	54.5	31.5	22.8	1.5
4-27	117	0808	54.0	31.5	22.9	1.4
4-26	116	0900	Unit start-up			
4-23	113	1400	Unit shut-down			
		1310	Acid flushed the membrane stack			
		0845	Biz flushed the membrane stack			
		0745	54.0	31.5	22.8	1.4
4-22	112	1545		31.5	22.9	1.4
		0910	Unit start-up			
		0835	Unit shut-down			
		0830	54.0	31.5	22.2	1.4
4-21	111	1410	Unit start-up			
		1320	Hydraulic start-up			
		1100	Unit shut-down			
		0945	Acid flushed the membrane stack			
		0816				
		0815	Unit start-up			
		0745	Unit shut-down			
		0744	54.0	31.5	22.7	1.4

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
4-20	110	1330	54.0	31.5	22.3	1.3
		0915	Unit start-up			
		0815	Unit shut-down			
4-19	109	0730	54.0	31.5	22.5	1.4
		1140	54.0	31.5	21.9	1.3
		1040	Unit start-up			
4-17	107	0706	Unit shut-down			
		0705	53.0	31.5	21.0	1.4
		1600	54.2	31.5	22.1	1.4
4-16	106	1200		31.5	22.2	1.4
		1130	Unit start-up			
		1037	Unit shut-down			
4-15	105	1030	54.2	31.5	22.5	1.4
		0715	54.2	31.5	22.3	1.4
		1145	54.3	31.5	22.5	1.4
4-14	104	1030	Unit start-up			
		0930	Acid flushed the membrane stack			
		0745	54.0	31.5	22.2	1.4
4-13	103	1130	54.2	31.5	22.2	1.4
		0838	Unit start-up			
		0801	Unit shut-down			
4-12	102	0745	54.2	31.5	22.2	1.4
		1500	Unit start-up			
		0800	Unit shut-down			
4-9	99	0730	54.2	31.5	22.2	1.4
		0900		31.5	22.0	1.4
		0820	Unit start-up			
4-8	98	0745	Unit shut-down			
		0730	54.4	31.5	22.0	1.4
		1500	54.2	31.5	22.7	1.4
4-7	97	1215	Unit start-up			
		0815	Unit shut-down			
		0701	Acid flushed the membrane stack			
4-7	97	0700	54.2	31.5	22.0	1.4
		1500	54.5	31.5	22.2	1.4
		0815	54.0	31.5	22.0	1.4
4-7	97	1415	54.4	31.5	22.1	1.4
		0950	54.0	31.5	22.0	1.4

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	D i l u t e S t r e a m			
			Feed Stream psig	Influent gal./min	psig	Effluent psig
4-6	96	1140	54.5	31.5	22.2	1.4
		1115	Unit start-up			
		0930	Unit shut-down			
4-5	95	0900	54.0	31.5	21.8	1.4
		1315	54.5	31.5	22.2	1.3
		0800	54.2	31.5	21.8	1.3
4-3	93	1435	54.5	31.5	22.5	1.3
		1425	Unit start-up			
		1330	Hydraulic start-up			
		1200	Unit shut-down			
		1100	Biz flushed the membrane stack			
4-2	92	1030	54.0	31.5	22.3	1.3
		1600	54.4	31.5	22.8	1.3
		1400	Unit start-up			
		1030	Acid flushed the membrane stack			
		0920	53.0	31.5	22.3	1.3
4-1	91	1510	54.0	31.5	22.9	1.3
3-31	90	0950	54.0	31.5	22.3	1.3
		0700	Unit start-up			
3-30	89	2100	Unit shut-down			
		0820		31.5	22.2	1.3
3-29	88	2300	Unit start-up			
		1700	Unit shut-down			
		1350	54.0	31.5	22.6	1.3
		1115	Unit start-up			
		1025	Unit shut-down			
3-27	86	1024	54.0	31.5	22.2	1.3
		0830	54.2	31.5	22.1	1.3
		1330	55.0	31.0	22.6	1.3
		1329	Unit start-up			
		1329	Unit shut-down			
3-26	85	1700	Unit shut-down			
		1500	52.8	31.5	22.1	1.3
		1315	Unit start-up			
		1200	Unit shut-down			
		1130	54.3	31.5	22.2	1.3
		1055	Unit start-up			
		1010	Hydraulic start-up			
		0736	Acid flushed the membrane stack			
		0735	54.3	31.5	22.1	1.3

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
3-25	84	1430		31.5	22.1	1.3
		1415	54.4	31.5	22.2	1.3
		1340	Unit start-up			
		1140	Unit shut-down			
		1139	54.4	31.5	22.1	1.3
		0740	54.2	31.5	22.0	1.3
3-24	83	1515		31.0	22.1	1.7
		1430	Unit start-up			
		1300	Unit shut-down			
		0815	54.3	31.5	22.0	1.4
3-23	82	1330	54.2	31.5	21.1	1.4
		1240	Unit start-up			
		0926	Acid flushed the membrane stack			
		0815	54.2	31.2	20.9	1.3
3-22	81	0830	55.0	31.5	20.4	1.3
3-20	79	1230	Unit start-up			
		1210	Unit shut-down			
		0910	54.0	21.5	21.2	1.3
3-19	78	1430		31.5	21.8	1.4
		0820	54.0	31.5	21.2	1.4
		0700	Unit start-up			
3-18	77	2000	Unit shut-down			
		1100	54.0	31.5	21.8	1.4
		1050	Unit start-up			
		0918	Unit shut-down			
3-17	76	0720	54.0	31.5	21.2	1.4
		1445	54.5	31.5	21.8	1.4
		0720	54.0	31.5	21.1	1.4
3-16	75	0735	54.0	32.1	21.6	1.4
3-15	74	1420		31.5	21.8	1.4
		1100	Unit start-up			
		0900	Unit shut-down			
		0720	52.0	22.0	21.5	1.4
3-12	71	1400	52.5	31.5	21.8	1.4
		0825	Unit start-up			
		0800	54.5	31.2	21.3	1.8
3-11	70	1515	54.5	31.5	22.2	1.8
		1500	Hydraulic start-up			

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	D i l u t e S t r e a m			
			Feed Stream psig	Influent gal./min	psig	Effluent psig
3-9	68	1100	Unit shut-down			
3-8	67	1420	55.0	31.5	21.0	1.4
		0830	Unit start-up			
		0800	Hydraulic start-up			
3-5	64	1445	Unit shut-down			
		1430	55.0	31.5	22.0	1.6
		1330	Unit start-up			
		0930	Unit shut-down			
		0830	Acid flushed the membrane stack			
		0730	55.0	31.5	21.5	1.3
3-4	63	1530	55.0	31.5	22.0	1.5
		1500	Unit start-up			
		1430	Unit shut-down			
3-3	62	1420	54.0	31.5	20.9	1.3
		0910	54.0	31.5	20.0	1.3
3-2	61	1420	54.0	31.5	20.7	1.4
		1330	Unit start-up			
		1220	Unit shut-down			
3-1	60	1240	55.0	31.5	20.8	1.4
		1045	Unit start-up			
		0930	Unit shut-down			
2-26	57	1520	55.0	30.1	20.2	1.4
		1419	Unit start-up			
		0930	Unit shut-down			
		0821	Acid flushed the membrane stack			
		0815	54.0	31.5	20.1	1.4
2-25	56	1355	54.0	31.5	20.9	1.4
2-24	55	1830	54.0	31.5	21.0	1.4
		1730	Unit start-up			
		1530	Hydraulic start-up			
2-23	54	0851	Unit shut-down			
		0850	54.0	31.5	20.7	1.5
2-22	53	1300	54.0	31.5	21.3	1.6
		1100	Unit start-up			

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
2-19	50	1515	Unit shut-down			
		1500	54.0	31.5	21.2	1.5
		1020	54.0	31.5	21.2	1.5
		1007	Unit start-up			
		0907	Unit shut-down			
		0806	Acid flushed the membrane stack			
		0800	54.0	32.0	21.0	1.5
2-18	49	1450	54.0	31.5	21.8	1.6
		0800	54.0	31.5	21.7	1.4
2-17	48	1500	54.0	31.5	22.0	1.8
		1430	Unit start-up			
2-16	47	1530	Unit shut-down			
		1400	Unit start-up			
2-11	42	0930	Unit shut-down			
		0815	Acid flushed the membrane stack			
		0800	53.0	31.5	20.7	1.4
2-10	41	1720	54.0	31.5	21.5	1.4
		1600	Unit start-up			
		0825	54.0	32.0	20.8	1.4
2-9	40	1814	54.5	31.5	21.2	1.1
		1530	Hydraulic operation only			
		1515	54.0	31.5	21.2	1.4
		1420	Unit start-up			
		1200	Unit shut-down			
		0830	55.0	31.5	20.3	1.4
2-8	39	1140	55.0	31.5	21.0	1.4
		1100	Unit start-up			
		1000	Unit shut-down			
		0825	54.0	31.5	20.5	1.4
2-6	37	1700	54.0	31.5	21.0	1.4
		1645	Unit start-up			
		1545	Unit shut-down			
2-5	36	1415	54.0	31.5	20.9	1.4
		0810	54.0	31.5	20.3	1.4
2-4	35	1520	54.0	31.5	20.7	1.4
		1415	Unit start-up			
		0930	Unit shut-down			
		0800		31.5	20.2	1.4

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1971	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
2-3	34	1900	54.0	31.5	20.6	1.4
		1750	54.0	31.5	20.5	1.4
		1700	Unit start-up			
		0800	Unit shut-down			
2-2	33	1007		31.5	20.1	1.3
		1006	Hydraulic start-up			
1-30	30	1200	Unit shut-down			
1-29	29	1430	54.0	31.5	19.9	1.4
		0802	54.0	31.5	19.5	1.4
1-28	28	1745	54.0	31.5	19.8	1.4
		0836	54.0	31.5	19.6	1.4
1-27	27	1550	54.0	31.5	20.2	1.5
		1530	54.0	31.5	20.5	1.4
		1529	Unit start-up			
1-15	15	1230	Unit shut-down			
		0923	Acid flushed the membrane stack			
		0830	54.0	31.5	19.4	1.3
1-14	14	1530	53.0	31.5	19.8	1.8
		1430	Unit start-up			
		0830	Biz flushed the membrane stack			
		0815	54.0	31.5	19.3	1.4
1-13	13	1410	54.0	31.5	19.6	1.4
		1000	54.0	31.5	19.4	1.4
		0955	Unit start-up			
		0900	Unit shut-down			
1-12	12	0855	54.0	31.5	19.4	1.4
		1600	54.0	31.5	19.5	1.5
		1430	54.0	31.5	19.8	1.5
		1415	54.0	31.5	19.8	1.5
		1410	Unit start-up			
		0800	Inspected the membrane stack			
1-7	7	1400	Unit shut-down			
		0800		31.5	19.1	1.3
		0730	Unit start-up			
1-6	6	1100	Hydraulic operation only			

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1970	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
12-18	352	1530	Unit shut-down			
		1500	53.0	31.5	19.5	1.4
		1300	54.0	31.5	19.5	1.4
		0720	53.0	31.5	19.5	1.4
12-17	351	1500	55.0	31.5	19.5	1.5
		1330	56.0	31.5	19.6	1.5
		1030	56.0	31.5	19.8	1.5
		0955	Unit start-up			
12-16	350	1000	Hand cleaned the membrane stack			
		0730	54.0	31.5	19.3	1.4
12-15	349	1515	53.0	31.5	19.0	1.4
		1400	52.0	31.5	19.0	1.4
		1345	Unit start-up			
12-14	348	1215	Unit shut-down			
		1030	53.0	31.5	19.6	1.4
		0930	Unit start-up			
12-10	344	1200	Unit shut-down			
		1145	52.0	31.5	19.6	1.5
		1130	Unit start-up			
		0600	Unit shut-down			
12-9	343	1500	Unit start-up			
		1305	Unit shut-down			
		1300	53.0	31.5	19.5	1.5
		1000	54.0	31.5	19.6	1.5
		0930	Unit start-up			
11-12	316		Hand cleaned the membrane stack			
11-5	309	0900	Unit shut-down			
11-4	308	1500	54.0	31.5	21.7	1.6
		1000	54.0	31.5	21.5	1.6
11-2	306	1530	52.0	31.5	20.9	1.6
		0730	54.0	31.5	20.9	1.9
10-30	303	1530	52.0	31.5	20.8	1.6
10-29	302	1000	54.0	31.5	20.5	1.6
10-28	301	1530	54.0	31.5	20.6	1.7
		1430	Unit start-up			
		0900	Unit shut-down			
		0700	Unit start-up			

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1970	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
10-27	300	2300	Unit shut-down			
		1500	54.0	31.5	21.5	1.7
		0730	54.0	31.5	20.9	1.6
10-26	299	1600	54.0	31.5	21.0	1.6
		1000	54.0	31.0	20.3	1.6
		0955	Unit start-up			
10-21	294	1100	Biz flushed the membrane stack			
		1000	Acid flushed the membrane stack			
10-20	293	1400	Unit shut-down			
		0830	56.0	28.0	24.0	1.6
10-19	292	0930	56.0	28.0	24.0	1.5
10-18	291	1500	56.0		24.0	2.0
10-16	289	1000	55.0	29.5	24.5	1.5
10-15	288	1000	55.0	29.5	24.2	1.6
10-14	287	1500	56.0	29.5	24.0	2.0
		1000	56.0	30.0	24.0	1.6
10-13	286	1130	55.0	31.5	24.4	1.6
		0830	55.0	31.5	24.0	1.6
		0800	Unit start-up			
10-12	285	1400	Unit shut-down			
		0900	55.0	31.5	23.0	1.6
		0830	Unit start-up			
10-1	274	1400	Unit shut-down			
		0835	55.0	31.5	20.5	1.6
9-30	273	1530	Unit start-up			
		1430	Unit shut-down			
		0830	55.0	31.5	23.0	1.5
		0800	55.0	31.5	23.0	1.6
9-29	272		Unit start-up			
8-28	240	0900	Unit shut-down			
		0800	58.0	31.5	24.0	1.7
8-27	239	1500	58.0	31.5	24.0	1.7
		1200	58.0	31.5	24.0	1.7
		0800	58.0	31.5	24.0	1.7
8-26	238	1400	56.0	31.2	24.0	1.7
		1300	Unit start-up			
		0700	Hydraulic start-up			

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1970	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
8-25	237	1500	Unit shut-down			
		1300	Hydraulic start-up			
		0700	Unit shut-down			
8-24	236	1530	57.0	31.5	24.0	1.7
		1230	57.0	31.5	24.0	1.7
		0945	58.0	31.5		
		0900	57.0	31.3	24.0	1.6
		0845	Unit start-up			
8-21	233	1500	Hydraulic start-up			
		0915	Unit shut-down			
		0845	55.0	31.5	24.0	1.5
		0800	55.0	31.5	23.8	1.7
8-20	232	1500	56.0	31.5	24.0	1.7
		1430	Unit start-up			
		1300	Unit shut-down			
		1200	56.0	31.5	23.7	1.7
		0900	56.0	31.5	23.0	1.7
		0800	56.0	31.5	23.5	1.7
8-19	231	1530	Unit start-up			
		1500	Unit shut-down			
		1200	56.0	31.5	21.9	1.7
		0900	56.0	31.5	22.0	1.5
8-18	230	2400	Unit start-up			
		2200	Unit shut-down			
		1500	56.0	31.5	21.4	1.7
		1445	Unit start-up			
		1430	Unit shut-down			
		1200	56.0	31.5	20.5	1.6
		0900	56.0	31.5	21.0	1.5
		0800	56.0	31.5	20.3	1.7
8-17	229	1500	56.0	31.5	20.2	1.7
		1300	56.0	31.5	20.2	1.7
		1000	56.0	31.5	20.0	1.5
		0900	56.0	31.5	20.2	1.7
8-14	226	1500	55.0	31.5	19.9	1.7
		0830		31.5	20.0	1.5
		0800	55.0	31.5	19.8	1.7

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1970	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
8-13	225	1530	56.0	31.5	19.8	1.7
		1400	Unit start-up			
		1000	Unit shut-down			
		0835		31.5	20.0	1.5
		0800	56.0	31.5	19.5	1.7
8-12	224	1500	56.0	31.5	19.6	1.7
		1200	56.0	31.5	19.6	1.7
		0800	56.0	31.5	19.5	1.7
8-11	223	1500	55.0	31.5	19.5	1.7
		1300	56.0	31.5	20.5	1.7
		1200	Unit start-up			
		1000	Unit shut-down			
		0800	56.0	31.5	19.5	1.7
8-10	222	1500		31.5	19.6	1.7
		1300		31.5	19.6	1.7
		0930		31.5	20.0	2.0
		0800		31.5	19.5	1.7
8-9	221	1500		31.5	20.0	2.0
8-7	219	1200		31.5	19.0	1.8
		1015		31.5	19.0	2.0
		0800		31.5	18.9	1.7
8-6	218	1500		31.5	18.9	1.8
		1300		31.5	18.8	1.7
		1255	Unit start-up			
		1245	Unit shut-down			
		0830		31.5	19.0	1.7
8-5	217	0800		31.5	18.7	1.7
		1615		31.5	18.6	2.0
		1200		31.5	18.9	1.6
8-5	217	1150	Unit start-up			
		1100	Unit shut-down			
		0900		31.5	18.8	1.7
		0830		31.5	18.0	2.0
8-4	216	1510		31.5	18.5	1.8
		1501		31.5	18.0	2.0
		1500	Unit start-up			
		0830	Hand cleaned the membrane stack			
		0800		31.5	22.0	1.7

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1970	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
8-3	215	1500		31.5	22.0	1.6
		1200		31.5	22.0	1.6
		0800		31.5	22.0	1.6
8-2	214	1300		31.5	22.0	2.0
7-31	212	1200		31.5	21.0	2.0
		0800		31.0	21.2	1.1
7-30	211	1500		31.5	21.0	1.2
		1100	Unit start-up			
7-29	210	2300	Unit shut-down			
		1200		31.5	22.0	1.4
		1000		31.5	22.0	1.7
		0830		31.5	22.0	2.0
		0730	Unit start-up			
7-28	209	0700	Hand cleaned the membrane stack			
7-27	208	1530	Unit start-up			
		1330	Unit shut-down			
		0900		31.5	22.0	1.5
		0800		29.4	23.5	1.6
7-24	205	0800		31.5	23.0	1.6
7-23	204	1500		31.5	22.8	1.6
		0806		31.5	21.0	1.5
		0800		31.4	21.0	1.6
7-22	203	1500		31.5	21.0	1.6
		1200		31.5	21.0	1.6
		0900		31.5	21.0	1.6
		0840		31.5	20.5	1.5
7-21	202	1200		31.5	21.0	1.6
		0900		31.5	21.0	1.6
		0840		31.5	20.0	1.5
7-20	201	1130		31.5	20.5	1.6
		0800		31.5	20.0	1.5
		0730		30.5	19.6	1.5
7-17	198	1500				
		1400				
		1300		31.5	19.6	1.6
		0900	58.0	31.5	20.0	1.5
		0830	58.0	31.5	20.0	1.5

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1970	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
7-16	197	1500	58.0	31.5	19.6	1.6
		1400	58.0	31.5	19.6	1.6
		1300	58.0	31.5	19.6	1.6
		1200	58.0	31.5	19.8	1.6
		1000				
		0900	58.0	31.5	19.6	1.6
7-15	196	0900	58.0	31.5	19.5	1.5
7-14	195	1500	Unit start-up			
		0800	Hand cleaned the membrane stack			
		0755	58.0	31.5	20.0	2.0
7-13	194	0830	58.0	31.5	21.0	1.5
7-10	191	0800	58.0	31.5	18.0	1.5
7-9	190	1530	58.0	31.5	19.0	1.5
		1525	Unit start-up			
		1500	Unit shut-down			
		0800	Unit start-up			
		0700	Unit shut-down			
7-8	189	1530	58.0	31.5	19.0	1.5
		1500	Unit start-up			
		0900	Hand cleaned the membrane stack			
7-6	187	0920	58.0	31.5	19.0	1.5
7-3	184	0800	58.0	31.5	19.0	1.5
		0700	Unit start-up			
7-1	182	1530	Unit shut-down			
		1100	58.0	31.5	19.0	1.5
6-30	181	1000	Unit start-up			
		0900	Unit shut-down			
		0840	58.0	31.5	19.0	1.5
6-29	180	0900	58.0	31.5		
6-26	177	0830	58.0	31.5	18.0	1.5
6-25	176	0800	58.0	31.5	18.0	1.0
6-24	175	1500	58.0	31.5	18.0	1.5
		1455	Unit start-up			
		0700	Hand cleaned the membrane stack			
6-23	174	1230	Unit start-up			
		1100	Unit shut-down			
		0800	58.0	31.5	19.0	1.5
6-22	173	0930	58.0	31.5	18.0	1.5

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1970	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
6-21	172	1300	57.0	31.5	19.0	1.5
6-20	171	1000	57.0	31.5	19.0	1.5
6-18	169	1030	58.0	31.5	19.0	2.4
6-17	168	0900	57.0	31.5	19.0	1.5
		0800	Unit start-up			
6-16	167	1330	Hydraulic operation only			
		0830	58.0	31.5	18.0	1.7
6-15	166	0900	58.0	31.5	18.0	1.7
6-14	165	1120	58.0	31.5	18.0	1.5
6-13	164	1100	58.0	31.5	18.0	1.5
6-12	163	1030	58.0	31.5	18.0	1.5
6-11	162	1530	Unit start-up			
		0800	Hand cleaned the membrane stack			
6-9	160	0900	58.0	31.5	20.0	1.5
		0800	Unit start-up			
6-8	159	0800	Hydraulic operation only			
6-5	156	0840	58.0	31.5	19.0	1.5
6-4	155	0800	58.0	31.5	19.0	1.5
6-3	154	0900	57.0	31.5	19.0	1.5
6-2	153	0900	58.0	31.5	18.5	1.7
6-1	152	0730	58.0	31.5	18.0	2.0
		0700	Unit start-up			
		(2400)	Unit shut-down			
5-30	150	1030	58.0	31.5	19.0	1.0
5-28	148	1500	56.0	31.5	19.0	1.0
		1455	Unit start-up			
		0720	Unit shut-down			
5-25	145	0800	Unit start-up			
5-22	142	0730	Hand cleaned the membrane stack			
		0720	57.0	31.5	23.0	2.0
5-21	141	1100	57.0	31.5	23.0	1.0
5-20	140	1200	58.0	31.5	22.0	1.0
5-19	139	0900	58.0	31.5	22.0	1.0
		0855	Tightened the membrane stack			
5-18	138	0705	57.0	31.5	21.0	2.0
		0700	Tightened the membrane stack			
5-17	137	1120	58.0	31.5	21.0	2.0

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1970	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
5-15	135	0800	58.0	31.5	22.0	2.0
5-14	134	0900	57.0	31.5	21.0	2.0
5-13	133	0900	57.0	31.5	21.0	3.0
5-12	132	1500	57.0	31.5	20.0	2.0
5-11	131	0800	57.0	31.5	22.0	2.0
5-10	130	1000	58.0	31.5	20.0	2.0
5-8	128	1330	57.0	31.5	20.0	2.0
		1000	57.0	31.5	20.0	2.0
5-7	127	0930	55.0	31.5	20.0	1.7
		0925	Unit start-up			
		0900	Unit shut-down			
5-6	126	1530	Unit start-up			
		1000	Hand cleaned the membrane stack			
		0930	58.0	31.5	19.0	2.0
5-5	125	0815	57.0	31.5	20.0	2.0
5-4	124	1400	58.0	31.5	20.0	2.1
		1000	58.0	31.5	20.0	2.1
		0955	Unit start-up			
4-27	117	1300	Unit shut-down			
		0700	57.0	31.5	20.0	2.0
4-24	114	0800	58.0	31.5	19.0	2.0
4-23	113	0700	58.0	31.5	19.0	2.0
4-22	112	1330	58.0	31.5	19.0	1.9
		0900	58.0	31.5	19.0	2.0
4-21	111	1330	57.0	31.5	19.0	2.0
		0900	57.0	31.5	19.5	2.0
4-20	110	1410	57.0	31.5	19.0	1.8
		1330	Unit start-up			
		1300	Unit shut-down			
		0900	57.0	31.5	20.0	1.8
		0830	Unit start-up			
		0700	Unit shut-down			
4-17	107	1500	57.0	31.5	20.0	2.2
		1330	57.0	31.5	19.0	2.0
		0900	57.0	31.5	19.0	2.0
4-16	106	1500	57.0	31.5	18.8	1.8
		1230	57.0	31.5	18.8	1.8
		0900	57.0	31.5	19.0	1.8

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 1 (CONTINUED)

1970	Day	Time	Feed Stream psig	D i l u t e S t r e a m		
				Influent gal./min	psig	Effluent psig
4-15	105	1500	56.0	31.5	26.0	2.9
		1230	57.0	31.5	26.0	2.5
		0900	56.0	31.5	27.0	3.0
		0700	Unit start-up			
4-14	104		Unit shut-down			
4-13	103	1400	Unit start-up			
		1335	Unit shut-down			
		1330	56.0	31.5	19.0	2.0
		0700	Unit start-up			
3-20	79	1130	Unit shut-down			
		1030	57.0	31.5	19.0	1.5
		1000	Unit start-up			
		0700	Unit shut-down			
3-19	78	1500	56.0	31.5	18.5	1.0
		1200	56.0	31.5	18.5	1.0
		0800	56.0	31.5	18.5	1.0
3-18	77	1500	57.0	31.5	18.0	1.7
		1200	58.0	31.5	18.0	2.0
		0800	58.0	31.5	19.0	2.0
3-17	76	1500	57.0	31.5	19.0	2.0
		1200	57.0	31.5	19.0	2.0
		0800	57.0	31.5	19.0	2.0
3-16	75	1500	58.0	31.5	19.0	2.0
		1200	58.0	31.5	19.0	2.0
		1130	Unit start-up			
		0815	Unit shut-down			
3-14	73	0800	58.0	31.5	18.0	2.0
3-14	73	0830	56.0	31.5	18.0	1.5
3-13	72	1500	58.0	31.5	17.5	1.5
		1200	57.0	31.5	17.5	1.5
		0800	56.0	31.5	18.0	2.0
3-12	71	1500	56.0	31.5	17.5	1.5
		1200	58.0	31.5	18.0	2.0

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential				Cathode Stream Influent psig	
		Membrane Stack Influent psig		Membrane Stack Effluent psig			
183	1340	1.0		0.9		16.0	
	1320	Unit start-up					
	0930	Acid flushed the membrane stack					
182	0737	1.0		0.5		16.0	
	1500	1.1		0.9		16.5	
	0720	1.0		0.5		16.0	
181	1312						
	1312	1.0		0.7		16.0	
	0735	1.1		0.7		15.2	
180	1430	1.0		1.3		16.2	
	1415						
	1330						
179	0715	1.0		1.2		16.0	
	1430	1.1		1.0		15.2	
	0930	1.0		1.1		15.8	
	0915						
	0740	0.4		0.7		15.8	
176	0735						
	1530						
	1525	0.4		1.2		16.0	
	0710						
175	0707	0.6		0.5		15.7	
	1520	0.7		1.2		16.2	
	1500						
	1435						
174	1400						
	1355	0.5				16.0	
	1200	1.0					
	1000	1.4		0.9		16.0	
	0732	1.5		0.9		15.3	
174	1530	1.5		1.1		16.0	
	1445						
	0930						
	0730						
	0705	3.0		0.8		15.0	

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential		Cathode Stream	
		Membrane Stack Influent	Membrane Stack Effluent	psig	psig
173	1515	1.5	0.8	16.0	
	1445				
	1400				
	1300				
	0710	1.5	0.8	16.0	
172	1500	1.4	0.9	16.0	
	1445				
	1200				
	0930				
	0830				
169	0730				
	0715	1.5	0.8	15.4	
	1500	1.4	0.9	16.2	
	0835	1.4	0.8	16.2	
	0750				
168	1700				
	1250	1.3	0.8	16.0	
	0720	1.3	0.8	15.0	
167	1500	1.4	0.8	16.2	
	1240				
	0905				
	0805				
	0710	0.4	0.5	14.0	
166	1500	0.6	0.4	15.5	
	1400				
	1100				
	1000				
	0710	0.8	0.7	15.0	
165	1510	0.7	0.7	16.0	
	1330	0.6	0.7	16.0	
	1325				
	1200				
	0930				
164	0815				
	0715				
	0700				
	1800				

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential		Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig	
162	1500	1.0	0.7	15.4
	0736			
	0713			
	0702	1.0	0.7	15.2
161	1430	1.0	0.7	15.8
	0805	1.0	0.7	16.1
160	1500	1.0	0.7	15.9
	0706	1.0	0.7	15.8
159	1515	1.0	0.7	16.2
	1022			
	0922			
	0750			
	0743	0.9	0.7	15.7
158	1530	1.0	0.7	16.0
	0708	0.9	0.7	15.6
155	1500	1.1	0.7	16.2
	1245			
	0815			
	0715			
	0705	1.1	0.7	15.9
154	1520	1.1	0.7	16.0
	1000	1.1	0.7	15.2
	0935			
	0715			
	0700	1.0	0.7	15.2
153	1517	1.1	0.7	16.0
	0747	1.0	0.7	16.0
152	1511	1.2	0.8	16.2
	1120			
	1115			
	0900			
	0800			
	0724	0.9	0.7	15.5
148	1450	0.8	0.7	16.0
	0800			
	0745	0.8	0.7	16.0
147	1500	0.8	0.6	14.7
	0745	0.8	0.7	14.4

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential			Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig		
146	1430	0.9	0.7		15.5
	0823	0.8	0.6		14.7
145	1435	0.9	0.7		16.2
	1330				
	1240				
	1000				
	0945				
	0820	0.8	0.7		15.0
144	1447	0.9	0.7		16.2
	1100	0.8	0.7		16.0
141	1315	1.0	0.6		16.0
	1245				
	1130				
	0830				
	0712				
	0705	1.1	0.7		15.8
140	1615	1.2	0.7		16.2
	1230	1.3	0.7		16.0
	0945				
	0915				
	0750	0.25	0.8		14.5
139	0740	0.8	0.6		15.0
138	2200	1.0	1.2		15.2
	1530	1.3	1.1		17.0
	1500				
	1315				
	0800				
	0720	1.0	0.7		16.0
137	1430	1.1	0.8		16.0
	0745	1.0	0.7		14.8
134	1444	1.0	0.6		16.0
	1240				
	0900				
	0730				
	0720	1.1	0.6		15.2
133	1615	1.1	0.5		15.5
	0730	1.1	0.6		14.8
132	1440	1.1	0.5		15.5
	0730	1.1	0.5		15.0

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential				Cathode Stream Influent psig	
		Membrane Stack Influent psig		Membrane Stack Effluent psig			
131	1515	1.1		0.5		16.0	
	1330						
	0910						
	0745						
	0710	1.1		0.2		15.0	
130	1514	1.2		0.05		16.0	
	0805	1.1		0.05		16.0	
127	1430	1.1		0.05		15.2	
	0700	1.0		0.00		14.5	
126	1330	0.9		0.00		14.5	
125	0745	0.9		0.00		15.0	
124	1440	0.9		0.00		15.2	
	0730	0.9		0.01		15.0	
123	1515	1.1		0.00		15.5	
120	1540	1.1		0.35		16.0	
	1320						
	1024						
	0900	1.0		0.30		15.3	
119	1500	1.0		0.30		16.2	
	0920	1.0		0.30		15.9	
118	0750	0.9		0.7		15.8	
117	0808	0.9		0.3		16.0	
116	0900						
113	1400						
	1300						
	0845						
	0745	1.2		0.1		14.2	
112	1545	1.4		0.1		16.0	
	0910						
	0835						
	0830	1.4		0.05		15.2	
111	1410						
	1320						
	1100						
	0945						
	0816						
	0815						
	0745						
	0744	1.2		0.2		15.0	

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential		Cathode Stream	
		Membrane Stack Influent psig	Membrane Stack Effluent psig	Influent psig	
110	1330	1.1	0.05	15.3	
	0915				
	0815				
109	0730	1.1	0.00	15.0	
	1140	1.1	0.4	15.0	
	1040				
107	0706				
	0705	1.0	1.2	15.0	
	1600	1.0	0.1	14.7	
	1200	0.9	0.1	15.0	
	1130				
106	1037				
	1030	1.0	0.05	14.2	
	0715	1.0	0.1	14.5	
105	1145	1.0	0.05	14.9	
	1030				
	0930				
104	0745	0.9	0.1	14.8	
	1130	1.0	0.05	14.8	
	0838				
	0801				
	0745	1.0	0.05	15.0	
103	1500				
	0800				
	0730	1.0	0.00	14.2	
102	0900	1.0	0.00	15.2	
	0820				
	0745				
99	0730	1.0	0.00	15.0	
	1500	1.2	0.01	15.0	
	1215				
	0815				
	0701				
98	0700	1.1	0.05	14.2	
	1500	1.1	0.05	15.2	
	0815	1.0	0.00	15.0	
97	1415	1.1	0.05	15.3	
	0950	1.0	0.00	15.0	

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential		Cathode Stream	
		Membrane Stack Influent psig	Membrane Stack Effluent psig	Influent psig	
96	1140	1.1	0.1	15.0	
	1115				
	0930				
	0900	1.0	0.0	14.0	
95	1315	1.0	0.0	15.2	
	0800	1.0	0.0	15.0	
93	1435	1.2	0.0	15.2	
	1425				
	1330				
	1200				
92	1100				
	1030	1.3	0.15	15.5	
	1600	1.5	0.15	15.9	
	1400				
91	1030				
	0920	1.3	0.2	14.8	
	1510	1.4	0.15	15.2	
90	0950	1.3	0.1	15.0	
	0700				
89	2100				
	0820	1.2	0.9	14.9	
88	2300				
	1700				
	1350	1.2	0.6	16.0	
	1115				
86	1025				
	1024	1.2	0.7	15.2	
	0830	1.2	0.7	15.0	
	1330	1.1	0.7	15.4	
85	1329				
	1700				
	1500	1.2	0.7	15.8	
	1315				
	1200				
	1130	1.3	0.7	15.8	
	1055				
	1010				
	0736				
	0735	1.2	0.7	14.7	

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential				Cathode Stream Influent psig	
		Membrane Stack Influent psig	Membrane Stack Effluent psig	Membrane Stack Influent psig	Membrane Stack Effluent psig		
84	1430	1.1	0.6			15.0	
	1415	1.2	1.1			14.8	
	1340						
	1140						
	1139	1.2	0.6			15.0	
83	0740	1.1	0.6			14.7	
	1515	1.1	1.1			14.9	
	1430						
	1300						
	0815	1.1	0.6			14.9	
82	1330	1.2	0.6			15.0	
	1240						
	0926						
81	0815	1.1	0.6			14.8	
	0830	1.1	1.0			14.2	
	1230						
79	1210						
	0910	0.9	0.7			14.0	
	1430	1.0	0.6			15.0	
	0820	1.0	0.8			14.0	
	0700						
77	2000						
	1100	1.0	0.6			15.0	
	1050						
	0918						
	0720	0.9	0.7			14.3	
76	1445	1.1	0.7			15.0	
	0720	1.0	0.1			14.2	
75	0735	1.1	0.0			14.7	
74	1420	1.0	0.0			15.5	
	1100						
	0900						
	0720	1.0	0.15			14.8	
	0720	1.0	0.15			14.8	
71	1400	1.1	0.05			15.5	
	0825						
	0800	1.0	0.45			14.8	
70	1515	1.4	0.4			15.5	
	1500						

**TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)**

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential		Cathode Stream	
		Membrane Stack Influent psig	Membrane Stack Effluent psig	Influent psig	
68	1100				
67	1420	0.8	0.0	17.0	
	0830				
	0800				
64	1445				
	1430	1.0	0.0	19.0	
	1330				
	0930				
	0830				
	0730	1.2	0.7	18.0	
63	1530	1.1		19.0	
	1500				
	1430				
62	1420	1.1	1.5	15.0	
	0910	1.2	1.2	14.0	
61	1420	1.1	1.3	15.0	
	1330				
	1220				
60	1240	1.0	1.8	14.7	
	1045				
	0930				
57	1520	0.8	1.0	15.1	
	1419				
	0930				
	0821				
	0815	1.0	1.8	14.2	
56	1355	1.0	1.6	15.3	
55	1830	1.0	0.9	15.0	
	1730				
	1530				
54	0851				
	0850	0.9	1.1	15.0	
53	1300	1.0	0.8	15.8	
	1100				

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential			Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig		
50	1515				
	1500	1.0	0.7		15.0
	1020	1.0	0.7		15.0
	1007				
	0907				
	0805				
49	0800	1.0	1.3		14.0
	1450	1.1	0.9		15.0
	0800	1.1	0.8		15.0
48	1500	1.2	0.6		15.3
	1430				
47	1530				
	1400				
42	0930				
	0815				
	0800	1.5	1.8		14.5
41	1720	1.5	0.7		15.8
	1600				
	0825	1.5	2.5		14.0
40	1814	1.4	0.9		16.1
	1530				
	1515	1.3	0.7		15.9
	1420				
	1200				
39	0830	1.3	1.9		14.5
	1140	1.2	0.9		15.5
	1100				
	1000				
	0825	1.2	1.4		15.0
37	1700	1.2	0.6		15.7
	1645				
	1545				
36	1415	1.2	0.7		15.5
	0810	1.2	1.5		14.7
35	1520	1.1	0.7		15.7
	1415				
	0930				
	0800	1.1			14.8

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1971 Day	Time	Dilute and Concentrate Stream Pressure Differential			Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig		
34	1900	1.1	0.7		15.2
	1750	1.0	0.7		15.2
	1700				
	0800				
33	1007	0.9	0.7		15.0
	1006				
30	1200				
29	1430	1.0	0.7		15.5
	0802	1.0	0.6		15.0
28	1745	1.0	0.8		
	0836	1.0	0.6		15.5
27	1550	1.0	0.7		15.5
	1530	1.0	0.7		15.2
	1529				
15	1230				
	0923				
	0830	1.0	0.6		15.0
14	1530	1.0	0.6		16.0
	1430				
	0830				
	0815	1.0	0.5		15.5
13	1410	1.0	0.6		16.0
	1000	1.0	0.6		16.0
	0955				
	0900				
	0855	1.0	0.6		16.0
12	1600	1.0	0.6		16.0
	1430	1.0	0.6		16.0
	1415	1.0	0.6		16.0
	1410				
	0800				
7	1400				
	0800	1.0	0.5		15.8
	0730				
6	1100				

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1970 Day	Time	Dilute and Concentrate Stream Pressure Differential			Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig		
352	1530				
	1500	1.0	0.7		15.2
	1300	1.0	0.7		15.0
	0720	1.0	0.8		15.0
351	1500	1.0	0.7		15.0
	1330	1.0	0.7		15.0
	1030	1.0	0.7		15.1
	0955				
350	1000				
	0730	1.0	0.7		15.2
349	1515	1.0	0.7		15.6
	1400	1.0	0.7		15.5
	1345				
348	1215				
	1030	1.0	0.7		15.0
	0930				
344	1200				
	1145	1.0	0.8		15.0
	1130				
	0600				
343	1500				
	1305				
	1300	1.0	0.8		15.0
	1000	1.0	0.8		15.0
	0930				
316					
309	0900				
308	1500	1.2	0.8		16.1
	1000	1.2	0.8		15.8
306	1530	1.2	0.6		16.0
	0730	1.2	1.2		16.0
303	1530	1.2	0.9		16.0
302	1000	1.2	0.8		16.0
301	1530	1.2	0.8		16.0
	1430				
	0900				
	0700				

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1970 Day	Time	Dilute and Concentrate Stream Pressure Differential			
		Membrane Stack Influent psig	Membrane Stack Effluent psig	Cathode Stream Influent psig	
300	2300				
	1500	1.2	0.8	15.0	
	0730	1.2	0.8	15.0	
299	1600	1.3		15.5	
	1000	1.4	0.8	16.0	
	0955				
294	1100				
	1000				
293	1400				
	0830	1.6	0.7	15.5	
292	0930	1.5	0.7	15.7	
291	1500	1.8	0.8	16.0	
289	1000	1.5	0.7	16.8	
288	1000	1.2	0.7	15.8	
287	1500	1.2	0.8	16.0	
	1000	1.1	0.8	16.0	
	1130	1.5	0.7	16.0	
286	0830	1.5	0.7	16.2	
	0800				
	1400				
285	0900	1.5	0.8		
	0830				
	1400				
274	0835	1.5	0.6	16.5	
273	1530				
	1430				
	0830	1.4	0.9	16.0	
	0800	1.4	0.9	17.0	
272					
240	0900				
	0800	1.6	0.9	16.5	
239	1500	1.7	1.0	17.0	
	1200	1.6	1.0	17.0	
	0800	1.7	1.0	16.0	
	1400	1.6	1.0	16.0	
238	1300				
	0700				

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1970 Day	Time	Dilute and Concentrate Stream Pressure Differential			Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig		
237	1500				
	1300				
	0700				
236	1530	1.6	0.9		15.0
	1230	1.6	0.9		15.2
	0945	1.6	1.4		
	0900	1.5	0.9		16.0
	0845				
233	1500				
	0915				
	0845	1.4			16.0
	0800	1.5	1.0		16.3
232	1500				
	1430	1.5	1.5		16.0
	1300				
	1200	1.5	1.0		16.0
	0900	1.5	0.9		16.0
	0800	1.5	0.8		15.8
231	1530				
	1500				
	1200	1.5	0.9		16.0
	0900	1.5	1.8		16.0
230	2400				
	2200				
	1500	1.2	0.9		15.8
	1445				
	1430				
	1200	1.5	0.9		16.5
	0900	1.4	0.9		16.0
	0800	1.5	0.9		16.0
229	1500	1.5	1.0		16.0
	1300	1.5	1.0		16.5
	1000	1.5	0.9		16.0
	0900	1.5	0.9		16.0
226	1500	1.6	0.9		16.2
	0830	1.5	0.9		16.0
	0800	1.5	0.9		16.5

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1970 Day	Time	Dilute and Concentrate Stream Pressure Differential		Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig	
225	1530	1.5	1.0	
	1400			
	1000			
	0835	1.4	0.9	16.0
	0800	1.5	0.9	
8-12	1500	1.5	1.0	16.0
	1200	1.4	0.9	16.0
	0800	1.4	0.9	16.0
223	1500	1.4	0.9	16.8
	1300	1.0	0.9	16.0
	1200			
	1000			
222	0800	1.4	0.9	15.8
	1500	1.4	1.0	15.8
	1300	1.4	1.0	16.0
	0930	1.4	0.9	16.0
	0800	1.4	0.9	16.0
221	1500	1.4	1.0	16.0
219	1200	1.4	1.0	15.5
	1015	1.4	1.0	16.0
	0800	1.4	1.0	15.9
218	1500	1.4	1.0	15.9
	1300	1.4	1.0	15.8
	1255			
	1245			
217	0830	1.4	1.0	16.0
	0800	1.4	1.0	16.8
	1615	1.4	1.0	16.0
	1200	1.4	1.0	16.0
	1155			
216	1100			
	0900	1.3	1.4	17.0
	0830	1.4	1.0	16.0
	1510	1.3	1.0	16.0
	1501	1.4	1.0	16.0
	1500			
	0830			
	0800	1.7	1.0	16.0

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1970 Day	Time	Dilute and Concentrate Stream Pressure Differential			
		Membrane Stack Influent psig	Membrane Stack Effluent psig	Cathode Stream Influent psig	
215	1500	1.6	1.5	16.0	
	1200	1.5	1.5	17.0	
	0800	1.5	1.5	16.0	
214	1300	1.5	1.5	16.0	
212	1300	0.8	1.7	17.0	
	0800	0.8	1.1	17.0	
211	1500	0.8	0.8	16.0	
	1100				
210	2300				
	1200	0.7	1.3	17.0	
	1000	0.8	1.3	17.0	
	0830	0.8	1.7	17.0	
	0730				
209	0700				
208	1530				
	1330				
	0900	1.5	0.9	16.0	
	0800	1.5	0.8	16.5	
205	0800	1.7	0.9	16.0	
204	1500	1.5	0.9	17.0	
	0806	1.5	0.9	16.0	
	0800	1.6	0.9	17.0	
203	1500	1.6	0.9	18.2	
	1200	1.6	0.9	18.2	
	0900	1.6	0.9	18.0	
	0840	1.5	1.5	16.0	
202	1200	1.6	0.8		
	0900	1.6	0.9	16.0	
	0840	1.5	0.9	16.0	
201	1130	1.4	0.8	16.2	
	0800	1.5	1.5	16.0	
	0730	1.4	0.8	15.8	
198	1500				
	1400				
	1300	1.3		16.0	
	0900	1.4	0.9	16.0	
	0830	1.3	0.9	16.0	

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1970 Day	Time	Dilute and Concentrate Stream Pressure Differential			Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig		
197	1500	1.3	1.1		16.0
	1400	1.3			16.0
	1300	1.3	1.1		16.0
	1200	1.3			15.8
	1000				
	0900	1.3			15.9
196	0900	1.3	1.3		16.0
195	1500				
	0800				
	0755	1.5	1.5		16.0
194	0830	1.2	1.4		16.0
191	0800	1.0	1.1		16.0
190	1530	0.9	1.0		16.0
	1525				
	1500				
	0800				
	0700				
189	1530	1.0	1.0		
	1500				
	0900				
187	0920	0.9	1.0		16.0
184	0800	0.9	1.0		16.0
	0700				
182	1530				
	1100	0.9	1.2		16.0
181	1000				
	0900				
	0840	0.9	1.1		16.0
180	0900	0.8	0.9		16.0
177	0830	1.0	1.0		16.0
176	0800	0.9	0.9		16.0
175	1500	0.9	1.1		16.0
	1455				
	0700				
174	1230				
	1100				
	0800	0.9	1.1		16.0
173	0930	0.9	1.1		16.0

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS
PART 2 (CONTINUED)

1970 Day	Time	Dilute and Concentrate Stream Pressure Differential			Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig		
172	1300	0.9	1.1		16.0
171	1000	0.9	1.1		16.0
169	1030	0.9	0.3		16.0
168	0900	0.9	1.1		16.0
	0800				
167	1330				
	0830	0.8	1.0		16.0
166	0900	0.8	1.0		16.0
165	1120	0.8	1.0		17.0
164	1100	0.8	1.1		17.0
163	1030	0.8	1.1		17.0
162	1530				
	0800				
160	0900	0.9	0.9		17.0
	0800				
159	0800				
156	0840	0.9	0.9		16.0
155	0800	0.9	0.9		16.0
154	0900	0.9	0.9		16.0
153	0900	0.9	0.9		16.0
152	0730	0.9	0.9		16.0
	0700				
	(2400)				
150	1030	1.0	1.0		16.0
148	1500	1.0	1.0		16.0
	1455				
	0720				
145	0800				
142	0730				
	0720	0.9	1.5		18.0
141	1100	0.9	1.5		17.0
140	1200	0.9	0.9		16.0
139	0900	0.9	0.9		16.0
	0855				
138	0705	1.0	0.9		18.0
	0700				
137	1120				18.0
136	1130				18.0

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1970 Day	Time	Dilute and Concentrate Stream Pressure Differential				
		Membrane Stack Influent	psig	Membrane Stack Effluent	psig	Cathode Stream Influent
135	0800	0.6		0.9		16.0
134	0900	0.7		0.9		16.0
133	0900	0.9		0.5		16.0
132	1500	1.0		1.1		17.0
131	0800	0.5		1.0		16.0
130	1000	0.8		1.8		16.0
129	0940	0.8		1.8		16.0
128	1330	0.9		0.9		
	1000	0.9		0.9		
127	0930	0.9		1.0		16.0
	0925					
	0900					
126	1530					
	1000					
	0930	0.8		1.5		16.0
125	0815	0.8				16.0
124	1400	0.9		1.6		16.0
	1000	0.9		1.6		16.0
	0955					
117	1300					
	0700	0.9		1.5		16.0
114	0800	0.8		1.5		16.0
113	0700	0.6		1.5		16.0
112	1330	0.8		1.5		16.0
	0900	0.9		1.5		16.0
111	1330	0.8		1.5		16.0
	0900	0.8		1.5		16.0
110	1410	0.8		1.5		16.0
	1330					
	1300					
	0900	0.8		1.5		16.0
	0830					
	0700					
107	1500	0.8		1.5		16.0
	1330	0.8		1.5		16.0
	0900	0.8		1.5		16.0
106	1500	0.8		1.3		16.0
	1230	0.9		1.3		17.0
	0900	0.8		1.3		16.0

TABLE B-1 ELECTRODIALYSIS DEMINERALIZER PRESSURES AND FLOWS,
PART 2 (CONTINUED)

1970 Day	Time	Dilute and Concentrate Stream Pressure Differential			Cathode Stream Influent psig
		Membrane Stack Influent psig	Membrane Stack Effluent psig		
105	1500	0.8	1.3		16.0
	1230	0.8	1.3		16.0
	0900	0.8	1.3		16.0
	0700				
104					
103	1400				
	1335				
	1330	1.0	1.5		16.0
	0700				
79	1130				
	1030	0.8	1.0		16.0
	1000				
	0700				
78	1500	1.0	1.3		16.0
	1200	1.0	1.3		16.0
	0800	1.0	1.3		16.0
77	1500	1.0	1.3		
	1200	1.0	1.5		
	0800	1.0	1.5		
76	1500	1.1	1.5		16.0
	1200	0.9	1.5		16.0
	0800	0.9	1.5		16.0
75	1500	0.9	1.5		16.0
	1200	0.9	1.5		17.0
	1130				
	0815				
	0800	0.8	1.5		16.0
73	0830	0.8	1.0		16.0
72	1500	0.8	1.0		16.0
	1200	0.8	1.0		16.0
	0800	0.8	1.5		16.0
71	1500	0.8	1.0		16.0
	1200	0.8	0.8		16.0

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES

1971	Day	Time	Concentrate Stream	Temperature °C	Dilute Stream Effluent
			Make-up gal./min		Solu Bridge @25°C micromhos/cm
7-2	183	1340	6.0	25	680
		1320	Unit start-up		
		0930	Acid flushed the membrane stack		
		0737	6.0	23	900
7-1	182	1500	6.0	25	750
		0720	6.0	23	790
6-30	181	1312	Started sand filter effluent		
		1312	6.0	25	620
		0735	6.0	23	690
6-29	180	1430	6.0	26	875
		1415	Unit start-up		
		1330	Unit shut-down		
		0715	6.0	23	700
6-28	179	1430	6.0	25	680
		0930	6.0	23	680
		0915	Unit start-up		
		0740	6.0		
		0735	Hydraulic start-up		
6-25	176	1530	Unit shut-down		
		1525	6.0		
		0710	Hand cleaned the membrane stack		
		0707	6.0	22	1000
6-24	175	1520	6.0	25	690
		1500	Unit start-up		
		1435	Unit shut-down		
		1400	Acid flushed the membrane stack		
		1355	6.0		
		1200	6.0		
		1000	6.0	23	1050
		0732	6.0	23	1080
6-23	174	1530	6.0	25	850
		1445	Unit start-up		
		0930	Unit shut-down		
		0730	EDTA flushed the membrane stack		
		0705	6.0	23	960

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream Make-up gal./min	Temperature °C	Dilute Stream Effluent Solu Bridge @25°C micromhos/cm
6-22	173	1515	6.0	26	800
		1445	Unit start-up		
		1400	Unit shut-down		
		1300	Acid flushed the membrane stack		
		0710	6.0	22	1080
6-21	172	1500	6.0	26	850
		1445	Unit start-up		
		1200	Unit shut-down		
		0930	Unit start-up		
		0830	Unit shut-down		
		0730	Acid flushed the membrane stack		
		0715	6.0	21	1150
6-18	164	1500	6.0	25	830
		0835	6.0	21	950
		0750	Unit start-up		
6-17	168	1700	Unit shut-down		
		1250	6.0	24	920
		0720	6.0	21	890
6-16	167	1500	6.0	25	670
		1240	Unit start-up		
		0905	Unit shut-down		
		0805	Acid flushed the membrane stack		
		0710	6.0	21	780
6-15	166	1500	6.0	26	730
		1400	Unit start-up		
		1100	Unit shut-down		
		1000	Biz flushed the membrane stack		
		0710	6.0	22	780
6-14	165	1510	6.0	25	710
		1330	6.0	25	700
		1325	Unit start-up		
		1200	Unit shut-down		
		0930	Unit start-up		
		0815	Unit shut-down		
		0715	Acid flushed the membrane stack		
		0700	Unit start-up		
6-13	164	1800	Unit shut-down		

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
6-11	162	1500	6.0	21	920
		0736	Unit start-up		
		0713	Unit shut-down		
		0702	6.0	21	950
6-10	161	1430	6.0	21	840
		0805	6.0	21	850
6-9	160	1500	6.0	21	860
		0706	6.0	21	890
6-8	159	1515	6.0	23	680
		1022	Unit start-up		
		0922	Unit shut-down		
		0750	Acid flushed the membrane stack		
		0743	6.0	21	940
6-7	158	1530	6.0	23	760
		0708	6.0	21	875
6-4	155	1500	6.0	23	700
		1245	Unit start-up		
		0815	Unit shut-down		
		0715	Acid flushed the membrane stack		
		0705	6.0	20	970
6-3	154	1520	6.0	21	900
		1000	6.0	18	940
		0935	Unit start-up		
		0715	Unit shut-down		
		0700	6.0	18	1030
6-2	153	1517	6.0	21	940
		0747	6.0	19	1000
6-1	152	1511	6.0	21	850
		1120	Tightened the membrane stack		
		1115	Unit start-up		
		0900	Unit shut-down		
		0800	Acid flushed the membrane stack		
		0724	6.0	19	1060
5-28	148	1450	6.0	19	750
		0800	Acid flushed the membrane stack		
		0745	6.0	19	920
5-27	147	1500	6.0	21	850
		0745	6.0	20	950

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
5-26	146	1430	6.0	22	960
		0823	6.0	21	820
5-25	145	1435	6.0	23	675
		1330	Unit start-up		
		1240	Hydraulic start-up		
		1000	Unit shut-down		
		0945	Acid flushed the membrane stack		
		0820	6.0	21	880
5-24	144	1447	6.0	23	800
		1100	6.0	22	850
5-21	141	1315	6.0	20	760
		1245	Unit start-up		
		1130	Hydraulic start-up		
		0830	Unit shut-down		
		0712	Acid flushed the membrane stack		
		0705	6.0	20	940
5-20	140	1615	6.0	23	720
		1230	6.0	22	810
		0945	Unit start-up		
		0915	Unit shut-down		
		0750	6.0	20	900
5-19	139	0740	6.0	20	700
5-18	138	2200	6.1	21	
		1530	6.0	24	
		1500	Unit start-up with one influent filter		
		1315	Acid flushed the membrane stack		
		0800	Biz flushed the membrane stack		
		0720	6.0	20	900
5-17	137	1430	6.0	23	900
		0745	6.0	21	960
5-14	134	1444	6.0	22	800
		1240	Unit start-up		
		0900	Acid flushed the membrane stack		
		0730	Unit shut-down		
		0720	6.0	21	1020
5-13	133	1615	6.0	23	910
		0730	6.0	21	970
5-12	132	1440	6.0	22	880
		0730	6.0	20	890

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
5-11	131	1515	6.0	22	780
		1330	Unit start-up		
		0910	Unit shut-down		
		0745	Acid flushed the membrane stack		
		0710	6.0	20	1030
5-10	130	1541	6.0	22	1000
		0805	6.0	19	1090
5-7	127	1430	6.0	21	830
		0700	6.0	19	920
5-6	126	1330	6.0		
5-5	125	0745	6.0	17	1000
5-4	124	1440	6.0	21	850
		0730	6.0	17	900
5-3	123	1515	6.0	21	810
4-30	120	1540	6.0	21	740
		1320	Unit start-up		
		1024	Acid flushed the membrane stack		
		0900	6.0	19	980
4-29	119	1500	6.0	21	910
		0920	6.0	17	990
4-28	118	0750	6.0	19	890
4-27	117	0808	6.0	18	890
4-26	116	0900	Unit start-up		
4-23	113	1400	Unit shut-down		
		1300	Acid flushed the membrane stack		
		0845	Biz flushed the membrane stack		
		0745	6.0	18	1020
4-22	112	1545	6.0	21	900
		0910	Unit start-up		
		0835	Unit shut-down		
		0830	6.0	19	990
4-21	111	1410	Unit start-up		
		1320	Hydraulic start-up		
		1100	Unit shut-down		
		0945	Acid flushed the membrane stack		
		0816	6.0	19	910
		0815	Unit start-up		
		0745	Unit shut-down		
		0744	6.0	19	980

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
4-20	110	1330	6.0	20	860
		0915	Unit start-up		
		0815	Unit shut-down		
		0730	6.0	19	1000
4-19	109	1140	6.0	18	920
		1040	Unit start-up		
		0706	Unit shut-down		
		0705	6.0	17	1030
4-17	107	1600	6.0	19	840
		1200	6.0	19.5	820
		1130	Unit start-up		
		1037	Unit shut-down		
		1030	6.0	19	
4-16	106	0715	6.0	19.5	960
4-15	105	1145	6.0	21	750
		1030	Unit start-up		
		0930	Acid flushed the membrane stack		
		0745	6.0	20	970
4-14	104	1130	6.0	19.5	900
		0838	Unit start-up		
		0801	Unit shut-down		
		0745	6.0	20	940
4-13	103	1500	Unit start-up		
		0800	Unit shut-down		
		0730	6.0	19.5	920
4-12	102	0900	6.0	20	840
		0820	Unit start-up		
		0745	Unit shut-down		
		0730	6.0	19	890
4-9	99	1500	6.0	22	710
		1215	Unit start-up		
		0815	Unit shut-down		
		0701	Acid flushed the membrane stack		
		0700	6.0	18	930
4-8	98	1500	6.0	21	940
		0815	6.0	19.5	930
4-7	97	1415	6.0	21	810
		0950	6.0	19.5	880

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Effluent Temperature °C	Solu Bridge @25°C micromhos/cm
4-6	96	1140	6.0	22	760
		1115	Unit start-up		
		0930	Unit shut-down		
		0900	6.0	20	870
4-5	95	1315	6.0	23	800
		0800	6.0	19	830
4-3	93	1485	6.0	22	690
		1425	Unit start-up		
		1330	Hydraulic start-up		
		1200	Unit shut-down		
		1100	Biz flushed the membrane stack		
		1030	6.0	20	820
4-2	92	1600	6.0	22	690
		1400	Unit start-up		
		1030	Acid flushed the membrane stack		
		0920	6.0	19.5	910
4-1	91	1510	6.0	24	780
3-31	90	0950	6.0	20	790
		0700	Unit start-up		
3-30	89	2100	Unit shut-down		
		0820	6.0	19	960
3-29	88	2300	Unit start-up		
		1700	Unit shut-down		
		1350	6.0	22	830
		1115	Unit start-up		
		1025	Unit shut-down		
		1024	6.0	21	920
		0830	6.0	19.5	990
3-27	86	1330	6.0	21	710
		1329	Unit start-up		
3-26	85	1700	Unit shut-down		
		1500	6.0	21	790
		1315	Unit start-up		
		1200	Unit shut-down		
		1130	6.0	21	780
		1055	Unit start-up		
		1010	Hydraulic start-up		
		0736	Acid flushed the membrane stack		
		0735	6.0	19.5	970

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream	Temperature °C	Dilute Stream Effluent	
			Make-up gal./min		Solu Bridge @25°C	micromhos/cm
3-25	84	1430	6.0		800	
		1415	6.0		1690	
		1340	Unit start-up			
		1140	Unit shut-down			
		1139	6.0	20	910	
3-24	83	0740	6.0	18	1000	
		1515	5.9			
		1430	Unit start-up			
		1300	Unit shut-down			
		0815	6.0	19	920	
3-23	82	1330	6.0	20	790	
		1240	Unit start-up			
		0925	Acid flushed the membrane stack			
		0815	6.1	18	1010	
		0830	6.0	18	1010	
3-22	81	1230	Unit start-up			
		1210	Unit shut-down			
		0910	6.0	18	970	
3-19	78	1430	6.1	21	820	
		0820	6.0	17	830	
		0700	Unit start-up			
3-18	77	2000	Unit shut-down			
		1100	6.0	19.5	820	
		1050	Unit start-up			
		0918	Unit shut-down			
		0720	6.0	18	980	
3-17	76	1445	5.8	20	910	
		0720	6.1	17	990	
		0735	6.2	17	990	
3-15	74	1420	6.0	20	870	
		1100	Unit start-up			
		0900	Unit shut-down			
		0720	6.4	17	990	
		1400	6.0	19.5	730	
3-12	71	0825	Unit start-up			
		0800	6.2	17	1800	
		1515	6.0	19.5	1800	
3-11	70	1500	Hydraulic start-up			
		1100	Unit shut-down			

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
3-8	67	1420	6.0	19	750
		0830	Unit start-up		
		0800	Hydraulic start-up		
3-5	64	1445	Unit shut-down		
		1430	6.0	18	750
		1330	Unit start-up		
		0930	Unit shut-down		
		0830	Acid flushed the membrane stack		
		0730	6.0	18	810
3-4	63	1530	6.0	18	860
		1500	Unit start-up		
		1430	Unit shut-down		
3-3	62	1420	6.0	19	720
		0910	6.3	16	810
3-2	61	1420	6.0	18	730
		1330	Unit start-up		
		1220	Unit shut-down		
3-1	60	1240	6.0	18	720
		1045	Unit start-up		
		0930	Unit shut-down		
2-26	57	1520	5.9	18	700
		1419	Unit start-up		
		0930	Unit shut-down		
		0821	Acid flushed the membrane stack		
		0815	6.2	17	790
2-25	56	1355	6.0	19	700
2-24	55	1830	6.0	18	790
		1730	Unit start-up		
		1530	Hydraulic start-up		
2-23	54	0851	Unit shut-down		
		0850	6.0	16	790
2-22	53	1300	6.0	17.5	740
		1100	Unit start-up		

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
2-19	50	1515	Unit shut-down		
		1500	6.0	17	760
		1020	6.0	17	730
		1007	Unit start-up		
		0907	Unit shut-down		
		0805	Acid flushed the membrane stack		
		0800	6.0	16	870
2-18	49	1450	6.0	18	810
		0800	6.0	17	860
2-17	48	1500	6.0	18	770
		1430	Unit start-up		
2-16	47	1530	Unit shut-down		
		1400	Unit start-up		
2-11	42	0930	Unit shut-down		
		0815	Acid flushed the membrane stack		
		0800	6.2	17	830
2-10	41	1720	6.0	19	680
		1600	Unit start-up		
		0825	6.3	16	
2-9	40	1814	6.0	19	
		1530	Hydraulic operation only		
		1515	6.0	20	
		1420	Unit start-up		
		1200	Unit shut-down		
		0830	6.0	17	1200
2-8	39	1140	6.0	18	770
		1100	Unit start-up		
		1000	Unit shut-down		
		0825	6.0	17	1010
2-6	37	1700	6.0	18	720
		1645	Unit start-up		
		1545	Unit shut-down		
2-5	36	1415	6.0	18	900
		0810	6.0	16	880
2-4	35	1520	6.0	18	720
		1415	Unit start-up		
		0930	Unit shut-down		
		0800	6.0	16	760

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1971	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
2-3	34	1900	6.0	17.5	730
		1750	6.0	17.5	760
		1700	Unit start-up		
		0800	Unit shut-down		
2-2	33	1006	Hydraulic start-up		
1-30	30	1200	Unit shut-down		
1-29	29	1430	6.0	20	860
		0802	6.0	17	900
1-28	28	1745	6.0	19	780
		0836	6.0	17	810
1-27	27	1550	6.0	19	680
		1530	6.0	19.5	
		1529	Unit start-up		
		1230	Unit shut-down		
1-15	15	0923	Acid flushed the membrane stack		
		0830	6.0	14.5	860
		1530	6.0	16	880
1-14	14	1430	Unit start-up		
		0830	Biz flushed the membrane stack		
		0815	6.0	15	880
		1410	6.0	17	810
1-13	13	1000	6.0	16	800
		0955	Unit start-up		
		0900	Unit shut-down		
		0855	6.0	16	770
1-12	12	1600	6.0	16	720
		1430	6.0	16	
		1415	6.0	16	
		1410	Unit start-up		
		0800	Inspected the membrane stack		
1-7	7	1400	Unit shut-down		
		0800	6.0	13	590
		0730	Unit start-up		
1-6	6	1100	Hydraulic operation only		

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1970	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
12-18	352	1530	Unit shut-down		
		1500	6.0	19	720
		1300	6.0	19	720
		0720	6.0	15	730
12-17	351	1500	6.0	18	590
		1330	6.0	19	610
		1030	6.0	19	640
		0955	Unit start-up		
12-16	350	1000	Hand cleaned the membrane stack		
		0730	6.0	19	1030
12-15	349	1515	6.0	18	740
		1400	6.0	18	730
		1345	Unit start-up		
12-14	348	1215	Unit shut-down		
		1030	6.0	19.5	690
		0930	Unit start-up		
12-10	344	1200	Unit shut-down		
		1145	6.0	20	730
		1130	Unit start-up		
		0600	Unit shut-down		
12-9	343	1500	Unit start-up		
		1305	Unit shut-down		
		1300	6.0	20	680
		1000	6.0	20	730
		0930	Unit start-up		
11-12	316		Hand cleaned the membrane stack		
11-5	309	0900	Unit shut-down		
11-4	308	1500	6.0	23	800
		1000	6.0	23	850
11-2	306	1530	6.0	24	680
		0730	6.0	21	850
10-30	303	1530	6.0	24	630
10-29	302	1000	6.0	22	680
10-28	301	1530	6.0	24	610
		1430	Unit start-up		
		0900	Unit shut-down		
		0700	Unit start-up		

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1970	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
10-27	300	2300	Unit shut-down		
		1500	6.0	24	640
		0730	6.0	21	610
10-26	299	1600	6.0	24	590
		1000	6.0	21	590
		0955	Unit start-up		
10-21	294	1100	Biz flushed the membrane stack		
		1000	Acid flushed the membrane stack		
10-20	293	1400	Unit shut-down		
		0830	6.0	24	580
10-19	292	0930	6.0	24	650
10-18	291	1500		26	650
10-16	289	1000	6.0	24	640
10-15	288	1000	6.0	24	650
10-14	287	1500	6.0		
		1000	6.0	24	610
10-13	286	1130	6.0	25	600
		0830	6.0	21	620
		0800	Unit start-up		
10-12	285	1400	Unit shut-down		
		0900	6.0		
		0830	Unit start-up		
10-1	274	1400	Unit shut-down		
		0835	6.0	24	720
9-30	273	1530	Unit start-up		
		1430	Unit shut-down		
		0830	6.0	25	700
		0800	6.0	25	710
9-29	272	0900	Unit start-up		
8-28	240	0900	Unit shut-down		
		0800	6.0	26	670
8-27	239	1500	6.0	29	610
		1200	6.0	28	610
		0800	6.0	27	660
8-26	238	1400	6.0	29	600
		1300	Unit start-up		
		0700	Hydraulic start-up		

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1970	Day	Time	Concentrate Stream	Temperature °C	Dilute Stream Effluent
			Make-up gal./min		Solu Bridge @25°C micromhos/cm
8-25	237	1500	Unit shut-down		
		1300	Hydraulic start-up		
		0700	Unit shut-down		
8-24	236	1530	6.0	29	610
		1230	6.0	28	630
		0945	6.0		630
		0900	6.0	27	640
		0845	Unit start-up		
8-21	233	1500	Hydraulic start-up		
		0915	Unit shut-down		
		0845	6.0		680
		0800	6.0	27	740
8-20	232	1500	6.0	28	650
		1430	Unit start-up		
		1300	Unit shut-down		
		1200	6.0	28	670
		0900	6.0		650
		0800	6.0	27	710
8-19	231	1530	Unit start-up		
		1500	Unit shut-down		
		1200	6.0	28	650
		0900	6.0	27	710
8-18	230	2400	Unit start-up		
		2200	Unit shut-down		
		1500	6.0	29	580
		1445	Unit start-up		
		1430	Unit shut-down		
		1200	6.0	28	610
		0900	6.0	27	610
		0800	6.0	27	640
8-17	229	1500	6.0	29	550
		1300	6.0	28	570
		1000	6.0		560
		0900	6.0	27	610
8-14	226	1500	6.0	29	590
		0830	6.0		620
		0800	6.0	27	630

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1970	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
8-13	225	1530	6.0	29	530
		1400	Unit start-up		
		1000	Unit shut-down		
		0835	6.0		
		0800	6.0	27	620
8-12	224	1500	6.0	29	590
		1200	6.0	28	610
		0800	6.0	27	630
8-11	223	1500	6.0	28	570
		1300	6.0	28	580
		1200	Unit start-up		
		1000	Unit shut-down		
		0800	6.0	27	650
8-10	222	1500	6.0	29	640
		1300	6.0	28	650
		0930	6.0		620
		0800	6.0	26	680
8-9	221	1500	6.0		
8-7	219	1200	6.0	28	660
		1015	6.0		680
		0800	6.0	26	720
8-6	218	1500	6.0	28	610
		1300	6.0	28	640
		1255	Unit start-up		
		1245	Unit shut-down		
		0830	6.0		650
		0800	6.0	25	680
8-5	217	1615	6.0		550
		1200			
		1155	Unit start-up		
		1100	Unit shut-down		
		0900	6.0	25	750
		0830	6.0		750
8-4	216	1510	6.0	26	690
		1501	6.0	26	650
		1500	Unit start-up		
		0830	Hand cleaned the membrane stack		
		0800	6.0	26	960

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1970	Day	Time	Concentrate Stream	Dilute Stream	
			Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
8-3	215	1500	6.0	28	860
		1200	6.0	27	860
		0800	6.0	25	880
8-2	214	1300	6.0	27	740
7-31	212	1300	6.0	28	700
		0800	6.2	25	750
7-30	211	1500	6.0	28	620
		1100	Unit start-up		
7-29	210	2300	Unit shut-down		
		1200	6.0	27	630
		1000	6.0	26	620
		0830	6.0	26	610
		0730	Unit start-up		
7-28	209	0700	Hand cleaned the membrane stack		
7-27	208	1530	Unit start-up		
		1330	Unit shut-down		
		0900	6.0	24	600
		0800	6.0	25	640
7-24	205	0800	6.0	25	710
7-23	204	1500	6.0	28	680
		0806	6.0	24	680
		0800	6.0	24	680
7-22	203	1500	6.0	28	580
		1200	6.0	27	580
		0900	6.0	26	580
		0840	6.0	26	600
7-21	202	1200	6.0	28	550
		0900	6.0	26	580
		0840	6.0	27	600
7-20	201	1130	6.0	28	570
		0800	6.0	26	600
		0730	5.9	26	610
7-17	198	1500		27	590
		1400		27	660
		1300	6.0		
		0900	6.0	26	600
		0830	6.0	26	620

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1970 Day	Time	Concentrate Stream	Dilute Stream	
		Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm
7-16	197	1500	6.0	
		1400	6.0	27
		1300	6.0	27
		1200	6.0	26
		1000	6.0	25
		0900	6.0	25
7-15	196	0900	6.0	26
7-14	195	1500	Unit start-up	610
		0800	Hand cleaned the membrane stack	
		0755	6.0	24
7-13	194	0830	6.0	24
7-10	191	0800	6.0	26
7-9	190	1530	6.0	27
		1525	Unit start-up	600
		1500	Unit shut-down	
		0800	Unit start-up	
		0700	Unit shut-down	
7-8	189	1530	6.0	26
		1500	Unit start-up	600
		0900	Hand cleaned the membrane stack	
7-6	187	0920	6.0	26
7-3	184	0800	6.0	24
		0700	Unit start-up	
7-1	182	1530	Unit shut-down	
		1100	6.0	24
6-30	181	1000	Unit start-up	
		0900	Unit shut-down	
		0840	6.0	24
6-29	180	0900	6.0	24
6-26	177	0830	6.0	24
6-25	176	0800	6.0	23
6-24	175	1500	6.0	27
		1455	Unit start-up	
		0700	Hand cleaned the membrane stack	
6-23	174	1230	Unit start-up	
		1100	Unit shut-down	
		0800	6.0	23
6-22	173	0930	6.0	24

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1970 Day	Time	Concentrate Stream	Dilute Stream		
		Make-up gal./min	Temperature °C	Effluent Solu Bridge @25°C micromhos/cm	
6-21	172	1300	6.0	26	720
6-20	171	1000	6.0	24	650
6-18	169	1030	6.0	23	650
6-17	168	0900	6.0	23	650
		0800	Unit start-up		
6-16	167	1330	Hydraulic operation only		
		0830	6.0	23	610
6-15	166	0900	6.0	23	620
6-14	165	1120	6.0	24	720
6-13	164	1100	6.0	23	720
6-12	163	1030	6.0	23	720
6-11	162	1530	Unit start-up		
		0800	Hand cleaned the membrane stack		
6-9	160	0900	6.0	23	730
		0800	Unit start-up		
6-8	159	0800	Hydraulic operation only		
6-5	156	0840	6.0	23	720
6-4	155	0800	6.0	23	720
6-3	154	0900	6.0	23	720
6-2	153	0900	6.0	22	690
6-1	152	0730	6.0	22	700
		0700	Unit start-up		
		2400	Unit shut-down		
5-30	150	1030	6.0	21	700
5-28	148	1500	6.0	21	700
		1455	Unit start-up		
		0720	Unit shut-down		
5-25	145	0800	Unit start-up		
5-22	142	0730	Hand cleaned the membrane stack		
		0720	6.0	21	790
5-21	141	1100	6.0	22	780
5-20	140	1200	6.0	22	700
5-19	139	0900	6.0	21	900
		0855	Tightened the membrane stack		
5-18	138	0705	6.0	22	700
		0700	Tightened the membrane stack		
5-17	137	1120	6.0	24	720
5-16	136	1130	6.0	24	720

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1970 Day	Time	Concentrate Stream		Dilute Stream Effluent	
		Make-up gal./min	Temperature °C	Solu Bridge @25°C micromhos/cm	
5-15	135 0800	6.0		750	
5-14	134 0900	6.0	21	750	
5-13	133 0900	6.0	19.5	750	
5-12	132 1500	6.0	21	740	
5-11	131 0800	6.0	21	750	
5-10	130 1000			750	
5-9	129 0940			750	
5-8	128 1330	6.0	22	740	
	1000	6.0	21	750	
5-7	127 0930	6.0	19.5	720	
	0925	Unit start-up			
	0900	Unit shut-down			
5-6	126 1530	Unit start-up			
	1000	Hand cleaned the membrane stack			
	0930	6.0	24	750	
5-5	125 0815	6.0	21	720	
5-4	124 1400	6.0	22	740	
	1000	6.0	21	730	
	0955	Unit start-up			
4-27	117 1300	Unit shut-down			
	0700	6.0	19	780	
4-24	114 0800	6.0	19	740	
4-23	113 0700	6.0	19.5	750	
4-22	112 1330	6.0	21	720	
	0900	6.0	20	750	
4-21	111 1330	6.0	19.5	730	
	0900	6.0	19.5	750	
4-20	110 1410	6.0	21	720	
	1330	Unit start-up			
	1300	Unit shut-down			
	0900	6.0	19.5	720	
	0830	Unit start-up			
	0700	Unit shut-down			
4-17	107 1500	6.0	20	770	
	1330	6.0	19.5	770	
	0900	6.0	19	770	

TABLE B-2 ELECTRODIALYSIS DEMINERALIZER STREAM FLOWS, TEMPERATURES, AND CONDUCTANCES (CONTINUED)

1970 Day	Time	Concentrate Stream Make-up gal./min	Dilute Stream Effluent	
			Temperature °C	Solu Bridge micromhos/cm
4-16	106	1500	6.0	20
		1230	6.0	20
		0900	6.0	20
4-15	105	1500	6.0	19.5
		1230	6.0	19.5
		0900	6.0	14.5
		0700	Unit start-up	
4-14	104	1400	Unit shut-down	
4-13	103	1400	Unit start-up	
		1335	Unit shut-down	
		1330	6.0	17
		0700	Unit start-up	790
3-20	79	1130	Unit shut-down	
		1030	6.0	
		1000	Unit start-up	720
		0700	Unit shut-down	
3-19	78	1500	6.0	21
		1200	6.0	20
		0800	6.0	18
3-18	77	1500	5.8	21
		1200	6.0	21
		0800	6.0	19
3-17	76	1500	6.0	21
		1200	6.0	20
		0800	6.0	18
3-16	75	1500	6.0	21
		1200	6.0	21
		1130	Unit start-up	
		0815	Unit shut-down	
		0800	6.0	18
3-14	73	0830	6.0	18
3-13	72	1500	6.0	21
		1200	6.0	20
		0800	6.0	18
3-12	71	1500	6.0	20
		1200	6.0	19

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
183	1340	125	95.	18.8	7.9
	1320				
	0930				
	0737	124	95	13.3	7.7
182	1500	126	95	16.1	8.1
	0720	125	95	16.1	7.9
181	1312				
	1312	127	95	19.5	8.5
	0735	124	95	19.6	8.6
180	1430	125	95	25.0	10.4
	1415				
	1330				
	0715	124	95	18.0	8.0
179	1430	126	95	20.1	9.2
	0930	125	95	21.9	9.9
	0915				
	0740				
176	0735				
	1530				
	1525				
	0710				
175	0707	124	95	11.8	7.6
	1520	126	95	15.5	7.4
	1500				
	1435				
174	1400				
	1355				
	1200				
	1000	126	95	12.7	7.1
	0732	124	95	10.2	6.6
	1530	126	95	14.2	7.6
	1445				
	0930				
	0730				
	0705	124	95	11.9	6.9

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
173	1515	126	95	14.0	7.6
	1445				
	1400				
	1300				
172	0710	124	95	11.8	7.4
	1500	128	95	12.5	7.8
	1445				
	1200				
169	0930				
	0830				
	0730				
	0715	124	95	9.0	7.1
168	1500	126	95	12.8	8.2
	0835	124	95	13.8	8.9
	0750				
167	1700				
	1250	126	95	13.5	7.9
	0720	124	95	13.7	7.7
166	1500	125	95	17.0	7.8
	1240				
	0905				
	0805				
165	0710	117	88	13.0	7.3
	1500	100	75	12.8	5.9
	1400				
	1100				
164	1000				
	0710	125	95	15.0	7.5
	1510	126	95	17.8	8.2
	1330	126	95	17.9	8.4
	1325				
	1200				
	0930				
	0815				
	0715				
	0700				
164	1800				

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
162	1500	123	95	16.8	8.6
	0736				
	0713				
	0702	124	95	15.6	8.6
161	1430	125	95	15.2	7.9
	0805	124	95	15.2	7.7
160	1500	125	95	16.6	8.4
	0706	124	95	17.4	9.2
159	1515	126	95	16.8	7.4
	1022				
	0922				
	0750				
	0743	125	95	16.0	8.9
158	1530	126	95	14.8	7.9
	0708	124	95	15.2	8.4
155	1500	125	95	18.1	8.3
	1245				
	0815				
	0715				
	0705	124	95	12.9	8.1
154	1520	125	95	14.2	8.4
	1000	125	95	14.8	8.4
	0935				
	0715				
	0700	122	95	12.2	7.7
153	1517	125	95	13.2	8.2
	0747	123	95	13.5	8.4
152	1511	125	95	16.5	8.8
	1120				
	1115				
	0900				
	0800				
	0724	124	95	12.2	8.5
148	1450	125	95	16.2	7.5
	0800				
	0745	124	95	13.3	7.4
147	1500	125	95	14.0	7.5
	0745	125	95	14.9	8.1

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
146	1430	126	95	15.6	8.2
	0823	125	95	16.1	8.4
145	1435	127	95	18.2	8.2
	1330				
	1240				
	1000				
	0945				
	0820	123	95	15.0	8.4
144	1447	126	95	14.8	7.6
	1100	125	95	14.7	8.4
141	1315	125	95	17.9	8.3
	1245				
	1130				
	0830				
	0712				
	0705	124	95	14.5	8.6
140	1615	125	95	17.0	8.4
	1230	126	95	16.3	8.9
	0945				
	0915				
	0705	125	95	14.5	8.4
139	0740	123	95	16.0	8.2
138	2200	125	92	18.2	8.6
	1530	126	95	18.2	8.4
	1500				
	1315				
	0800				
	0720	125	95	14.0	8.2
137	1430	127	95	14.6	8.1
	0745	124	95	14.5	8.4
134	1444	125	95	18.0	8.6
	1240				
	0900				
	0730				
	0720	123	95	14.2	8.6
133	1615	126	95	14.2	8.0
	0730	123	95	14.8	8.5
132	1440	125	95	15.0	8.4
	0730	127	95	16.1	8.6

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
131	1515	125	95	17.6	8.2
	1330				
	0910				
	0745				
	0710	124	95	12.9	8.0
130	1541	125	95	13.7	8.1
	0805	124	95	13.7	8.4
127	1430	125	95	15.1	8.1
	0700	123	95	16.2	8.7
126	1330	125	95	14.1	8.3
125	0745	125	90	15.5	8.5
124	1440	125	95	15.2	8.1
	0730	125	95	16.0	8.5
123	1515	125	96	16.6	8.3
120	1540	125	95	18.1	8.2
	1320				
	1024				
	0900	124	95	15.0	8.2
119	1500	125	95	14.9	8.4
	0920	125	95	15.2	8.5
118	0750	124	95	16.2	8.4
117	0808	123	95	17.1	8.4
116	0900				
113	1400				
	1300				
	0845				
	0745	123	95	13.5	8.1
112	1545	125	95	15.6	8.4
	0910				
	0835	125	95	16.2	8.4
	0830	125	95	14.8	8.4
111	1410				
	1320				
	1100				
	0945				
	0816	124	95	14.9	8.0
	0815				
	0745				
	0744	124	95	14.5	8.5

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
110	1330	125	95	15.8	8.0
	0915				
	0815				
109	0730	123	95	14.0	7.9
	1140	125	95	16.8	8.1
	1040				
	0706				
107	0705	123	95	13.0	7.6
	1600	124	95	15.2	7.9
	1200	124	95	16.8	8.4
	1130				
	1037				
106	1030	124	95	13.2	7.7
	0715	125	95	14.9	8.5
105	1145	125	95	17.3	8.1
	1030				
	0930				
104	0745	124	95	13.2	7.7
	1130	126	95	14.8	8.1
	0838				
	0801				
103	0745	125	95	14.9	8.5
	1500				
	0800				
102	0730	123	95	15.7	8.2
	0900	124	95	16.1	8.4
	0820				
	0745				
99	0730	122	95	15.1	8.3
	1500	125	95	18.2	8.4
	1215				
	0815				
	0701				
98	0700	125	95	15.0	8.2
	1500	125	95	15.7	8.4
	0815	124	95	15.3	8.4
97	1415	125	95	15.9	8.3
	0950	125	95	15.9	8.4

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
96	1140	126	95	17.9	8.5
	1115				
	0930				
	0900	124	95	15.5	8.4
95	1315	126	95	16.7	8.4
	0800	125	95	16.2	8.3
93	1435	125	95	17.0	7.4
	1425				
	1330				
	1200				
	1100				
	1030	125	95	16.3	8.4
92	1600	125	95	17.2	8.2
	1400				
	1030				
	0920	125	95	14.8	8.4
91	1510				
90	0950	125	95	16.2	8.5
	0700				
89	2100				
	0820	124	95	16.0	8.9
88	2300				
	1700				
	1350	126	95	15.9	8.1
	1115				
	1025				
	1024	126	95	14.0	7.7
	0830	125	95	13.8	7.6
86	1330	124	95	17.1	8.3
	1329				
85	1700				
	1500	125	95	17.0	8.1
	1315				
	1200				
	1130	125	95	16.9	8.2
	1055				
	1010				
	0736				
	0735	124	95	14.5	8.1

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
84	1430	125	95	16.2	8.1
	1415				
	1340				
	1140				
	1139	126	95	14.8	8.0
	0740	124	95	15.0	8.4
83	1515				
	1430				
	1300				
	0815	126	95	15.3	8.4
82	1330	126	95	17.2	8.5
	1240				
	0926				
	0815	125	96	13.3	7.8
81	0830	124	95	13.9	8.1
79	1230				
	1210				
	0910	124	95	15.2	8.3
78	1430	126	95	16.9	8.6
	0820	125	95	17.6	8.6
	0700				
77	2000				
	1100	125	95	16.3	8.4
	1050				
	0918				
	0720	124	95	14.6	8.2
76	1445	126	95	15.1	8.4
	0720	123	95	15.0	8.4
75	0735	124	95	14.8	8.6
74	1420	126	95	16.0	8.6
	1100				
	0900				
	0720	123	95	14.0	8.5
71	1400	125	95	17.5	8.4
	0825				
	0800				
70	1515				
	1500				
68	1100				

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
67	1420	125	95	17.0	8.2
	0830				
	0800				
64	1445				
	1430	125	95	16.8	8.5
	1330				
	0930				
	0830				
	0730	125	95	16.5	8.5
63	1530	125	95	18.1	8.5
	1500				
	1430				
62	1420	125	95	15.0	7.4
	0910	125	95	14.9	7.5
61	1420	124	95	16.0	8.1
	1330				
	1220				
60	1240	125	95	16.1	7.9
	1045				
	0930				
57	1520	125	95	16.8	8.4
	1419				
	0930				
	0821				
	0815	125	95	15.9	8.1
56	1355	126	95	16.1	7.9
55	1830	126	96	15.6	7.5
	1730				
	1530				
54	0851				
	0850	125	95	16.2	8.2
53	1300	125	95	17.2	8.3
	1100				

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
50	1515				
	1500	125	95	16.9	8.1
	1020	125	95	17.1	8.3
	1007				
	0907				
	0806				
	0800	124	95	15.2	8.2
49	1450				
	0800	125	95	16.7	8.8
48	1500	125	95	16.4	8.2
	1430				
47	1530				
	1400				
42	0930				
	0815				
	0800	124	95	14.7	7.4
41	1720	126	95	16.1	7.4
	1600				
	0825				
40	1814				
	1530				
	1515	126	95	16.3	7.7
	1420				
	1200				
	0830	125	95	11.0	7.4
39	1140	125	95	15.2	7.8
	1100				
	1000				
	0825	124	95	11.7	8.1
37	1700	124	95.	15.2	7.6
	1645				
	1545				
36	1415	126	95	13.0	8.5
	0810	124	95	13.9	8.4
35	1520	126	93	16.8	7.6
	1415				
	0930				
	0800	124	96		

**TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)**

1971 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
34	1900	127	95	17.9	7.9
	1750	126	95	17.6	8.2
	1700				
	0800				
33	1006				
30	1200				
29	1430	123	95	13.8	8.5
	0802	124	95	13.5	8.6
28	1745	126	95	15.3	7.3
	0836	124	95	16.3	7.6
27	1550	126	95	16.8	7.4
	1530				
	1529				
15	1230				
	0923				
	0830	124	95	12.5	7.8
14	1530	125	95	14.2	7.8
	1430				
	0830				
	0815	124	95	14.0	8.1
13	1410	125	95	16.0	8.2
	1000	125	95	15.6	7.9
	0955				
	0900				
	0855	125	95	16.0	8.2
12	1600	125	95	17.7	8.7
	1430				
	1415				
	1410				
	0800				
7	1400				
	0800	124	95	15.2	7.6
	0730				
6	1100				

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1970 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
352	1530				
	1500	125	95	14.5	8.4
	1300	125	95	15.0	8.4
	0720	122	95	15.5	8.6
351	1500	125	95	17.3	8.0
	1330	125	95	17.7	8.2
	1030	125	95	18.2	8.8
	0955				
350	1000				
	0730	125	95	15.2	7.8
349	1515	125	95	15.9	7.4
	1400	125	95	15.3	7.5
	1345				
348	1215				
	1030	124	95	16.8	8.1
	0930				
344	1200				
	1145	125	95	14.8	7.8
	1130				
	0600				
343	1500				
	1305				
	1300	125	95	14.8	7.1
	1000	124	95	15.2	7.5
	0930				
316					
309	0900				
308	1500	125	95	14.3	8.6
	1000	125	95	14.1	9.3
306	1530	125	95	16.7	9.0
	0730	124	95	14.1	9.0
303	1530	126	95	18.2	9.2
302	1000	125	95	17.4	8.9
301	1530	125	95	19.5	8.8
	1430				
	0900				
	0700				

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND VOLTAGE
(CONTINUED)

1970 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
300	2300				
	1500	125	92	19.5	9.1
	0730	116	95	19.1	9.5
299	1600	120	95	19.4	9.0
	1000	123	95	18.8	8.8
	0955				
294	1100				
	1000				
293	1400				
	0830	125	95	16.0	7.9
292	0930	125	95	14.5	7.9
291	1500	125	95	15.4	8.5
289	1000	125	98	15.5	8.5
288	1000	124	95	15.3	8.2
287	1500	125	95	16.0	8.0
	1000	123	95	16.0	8.0
286	1130	121	95	17.7	8.2
	0830	124	94	16.6	8.0
	0800				
285	1400				
	0900				
	0830				
274	1400				
	0835	124	95	19.0	8.9
273	1530				
	1430				
	0830	125	95	18.0	8.6
	0800	121	95	17.1	8.4
272	0900				
240	0900				
	0800	125	95	17.0	8.6
239	1500	125	95	17.1	8.4
	1200	125	95	17.5	8.4
	0800	125	95	17.3	8.5
238	1400	124	95	17.8	8.6
	1300				
	0700				

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1970 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
237	1500				
	1300				
	0700				
236	1530	124	95	18.1	8.8
	1230	124	95	18.1	9.1
	0945	125	95	18.3	9.2
	0900	126	95	18.4	9.2
	0845				
233	1500				
	0915				
	0845	125	95	18.3	9.7
	0800	124	95	18.2	9.7
232	1500	124	95	16.2	8.4
	1430				
	1300				
	1200	123	95	17.0	8.7
	0900	125	95	18.0	8.3
	0800	124	95	17.7	9.2
231	1530				
	1500				
	1200	127	95	19.0	9.5
	0900	125	95	17.9	9.7
230	2400				
	2200				
	1500	124	95	17.0	8.4
	1445				
	1430				
	1200	123	95	16.9	8.6
	0900	125	95	17.4	8.6
	0800	124	95	17.2	8.8
229	1500	124	95	18.0	8.4
	1300	124	95	18.2	8.6
	1000	125	95	18.5	9.0
	0900	125	95	18.0	8.7
226	1500	124	95	17.8	8.4
	0830	125	95	18.0	9.0
	0800	124	95	17.8	8.9

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1970 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
225	1530	124	95	17.9	8.4
	1400				
	1000				
	0835	125	95	17.7	8.7
	0800	125	95	17.0	8.8
224	1500	124	95	18.2	8.7
	1200	124	95	18.2	9.0
	0800	124	95	17.4	8.9
223	1500	124	95	17.8	8.6
	1300	124	95	18.0	8.7
	1200				
	1000				
	0800	124	95	17.5	8.9
222	1500	124	95	18.3	9.3
	1300	124	95	18.3	9.4
	0930	125	95	18.5	9.5
	0800	125	96	18.4	9.4
221	1500	125	95	19.0	9.3
219	1200	124	95	19.0	9.5
	1015	125	95	19.0	10.0
	0800	124	95	17.8	9.6
218	1500	124	94	19.0	9.4
	1300	124	94	18.2	9.3
	1255				
	1245				
	0830	126	96	18.0	9.4
	0800	124	98	17.9	9.4
217	1615	125	95	19.0	9.0
	1200				
	1155				
	1100				
	0900	124	94	17.1	9.6
	0830	125	95	17.0	9.0
216	1510	125	95	19.6	10.0
	1501	125	95	18.5	10.0
	1500				
	0830				
	0800	124	96	13.2	9.4

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1970 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
215	1500	124	95	13.2	9.1
	1200	128	96	13.8	9.4
	0800	124	95	14.1	9.4
214	1300	125	95	16.0	9.0
212	1300	125	95	17.5	9.0
	0800	124	95	15.7	8.7
211	1500	124	95	18.0	8.9
	1100				
210	2300				
	1200	124	94	19.2	9.0
	1000	126	96	19.8	9.1
	0830	125	95	19.0	9.0
	0730				
209	0700				
208	1530				
	1330				
	0900	125	95	17.2	8.6
	0800	124	96	16.9	8.1
205	0800	124	97	16.4	8.3
204	1500	124	94	16.6	8.2
	0806	124	95	16.6	8.6
	0800	124	96	16.2	8.8
203	1500	129	97	18.0	8.7
	1200	128	96	18.2	8.9
	0900	122	97	17.2	8.8
	0840	126	95	18.1	9.0
202	1200	126	99	17.9	8.8
	0900	125	95	18.0	9.0
	0840	125	95	18.0	9.0
201	1130	129	99	18.6	9.2
	0800	125	95	18.0	9.0
	0730	117	96	16.8	8.9
198	1500	124	95.5	18.8	9.3
	1400	124	95.5	18.3	9.3
	1300	125	95	18.3	9.3
	0900	125	95	19.0	9.3
	0830	123	95	18.5	9.5

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1970 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
197	1500	124	95	19.0	9.3
	1400	123	96	18.6	9.3
	1300	124	99	19.0	9.5
	1200	120	96	18.7	9.4
	1000	120	96	18.8	9.6
	0900	119	93	18.8	9.4
196	0900	120	95	19.0	9.5
195	1500				
	0800				
	0755	125	95	15.0	9.5
194	0830	125	95	16.6	9.5
191	0800	125	95	18.0	9.2
190	1530	125	95	16.6	8.3
	1525				
	1500				
	0800				
	0700				
189	1530	125	95	16.6	8.3
	1500				
	0900				
187	0920	125	95	17.0	9.5
184	0800	125	95	19.0	9.5
	0700				
182	1530				
	1100	125	95	19.0	9.5
181	1000				
	0900				
	0840	125	95	19.0	10.0
180	0900	125	95	18.5	9.6
177	0830	125	95	19.0	9.5
176	0800	125	95	18.5	9.1
175	1500	125	95	18.5	9.0
	1455				
	0700				
174	1230				
	1100				
	0800	125	95	17.0	9.2
173	0930	125	95	18.1	9.0

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1970 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
172	1300	125	95	20.0	9.5
171	1000	125	95	20.0	9.5
169	1030	125	95	19.0	9.6
168	0900	125	95	20.0	9.5
	0800				
167	1330				
	0830	120	95	19.0	9.5
166	0900	125	95	19.0	10.0
165	1120	125	95	15.0	8.3
164	1100	125	95	15.0	8.3
163	1030	125	95	15.0	8.3
162	1530				
	0800				
160	0900	125	95	16.0	8.2
	0800				
159	0800				
156	0840	125	95	16.8	8.5
155	0800	125	95	16.8	8.5
154	0900	125	95	18.0	8.3
153	0900	125	95	17.9	8.1
152	0730	125	95	19.0	8.6
	0700				
	2400				
150	1030	125	95	16.6	8.3
148	1500	124	95	17.5	8.4
	1455				
	0720				
145	0800				
142	0730				
	0720	145	100	16.6	8.3
141	1100	150	105	16.6	8.3
140	1200	140	105	16.6	8.3
139	0900	130	95	16.6	8.3
	0855				
138	0705	125	100	16.6	8.3
	0700				
137	1120	120	85	16.6	8.3
136	1130	120	85	16.6	8.3

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1970 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
135	0800	130	95	16.4	8.3
134	0900	133	100	16.6	8.3
133	0900	125	95	16.7	8.3
132	1500	125	98	16.6	8.3
131	0800	130	100	16.6	8.3
130	1000	115	90	16.6	8.3
129	0940	115	90	16.6	8.3
128	1330	125	95	16.6	8.3
	1000	125	95	16.6	8.3
127	0930	125	95	16.6	8.3
	0925				
	0900				
126	1530				
	1000				
	0930	132	98	16.6	8.7
125	0815	120	81	16.6	8.3
124	1400	121	85	16.6	8.3
	1000	121	85	16.6	8.3
	0955				
117	1300				
	0700	125	94	16.6	8.3
114	0800	120	95	16.6	8.3
113	0700	130	95	16.6	8.3
112	1330	124	95	16.6	8.3
	0900	124	95	16.6	8.3
111	1330	120	70	16.6	8.3
	0900	120	88	16.6	8.3
110	1410	124	94	16.6	8.3
	1330				
	1300				
	0900	115	90	17.0	8.3
	0830				
	0700				
107	1500	137	115	16.6	8.3
	1330	137	115	16.6	8.3
	0900	137	115	16.6	8.3

TABLE B-3 ELECTRODIALYSIS DEMINERALIZER STACK VOLTAGE AND CURRENT
(CONTINUED)

1970 Day	Time	M e m b r a n e S t a c k			
		Voltage		Amperage	
		First Stage	Second Stage	First Stage	Second Stage
106	1500	135	115	16.6	8.3
	1230	135	115	16.6	8.3
	0900	135	115	16.6	8.3
105	1500	135	115	16.6	8.3
	1230	135	130	16.6	8.3
	0900	155	130	16.0	8.3
	0700				
104	1400				
103	1400				
	1335				
	1330	130	100	16.6	8.3
	0700				
79	1130				
	1030	140	115	16.6	8.3
	1000				
	0700				
78	1500	148	120	17.0	8.3
	1200	145	120	16.8	8.4
	0800	145	110	16.6	8.0
77	1500	120	95	17.0	8.6
	1200	120	95	17.0	8.5
	0800	120	95	16.6	8.3
76	1500	125	95	16.9	8.2
	1200	125	95	16.6	8.3
	0800	125	95	16.6	8.3
75	1500	125	94	16.6	8.3
	1200	124	94	16.6	8.3
	1130				
	0815				
	0800	152	110	16.6	8.3
73	0830	155	105	16.2	8.3
72	1500	130	100	16.6	8.3
	1200	130	100	16.6	8.3
	0800	145	102	16.6	8.3
71	1500	115	90	17.0	8.4
	1200	115	90	17.0	8.4

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
7-2	183	1340	1400	890	615	4050
		1320	Unit start-up			
		0930	Acid flushed the membrane stack			
7-1	182	0737	1440	1100	855	3420
		1500	1610	1110	745	3420
		0720	1660	1090	800	5260
6-30	181	1312	Started sand filter influent			
		1312	1620	1000	650	5660
		0735	1690	1150	710	5540
6-29	180	1430	2020	1340	925	6410
		1415	Unit start-up			
		1330	Unit shut-down			
6-28	179	0715	1720	1060	725	
		1430	1730	1090	785	6240
		0930	1760	1080	720	5400
		0915	Unit start-up			
		0740				
6-25	176	0735	Hydraulic start-up			
		1520	Unit shut-down			
		1525				
6-24	175	0710	Hand cleaned the membrane stack			
		0707	1710	1300	1040	4680
		1520	1600	1110	770	4800
		1500	Unit start-up			
		1435	Unit shut-down			
6-23	174	1400	Acid flushed the membrane stack			
		1355				
		1200				
		1000	1570	1200	904	4200
		0732	1630	1320	1060	4160
		1530	1680	1290	985	4340
		1445	Unit start-up			
		0930	Unit shut-down			
		0730	EDTA Flushed the membrane stack			
		0705	1640	1190	880	4770

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
6-22	173	1515	1640	1190	860	4600
		1445	Unit start-up			
		1400	Unit shut-down			
		1300	Acid flushed the membrane stack			
		0710	1740	1400	1070	4680
6-21	172	1500	1650	1260	930	4560
		1445	Unit start-up			
		1200	Unit shut-down			
		0930	Unit start-up			
		0830	Unit shut-down			
6-18	169	0730	Acid flushed the membrane stack			
		0715	1720	1490	1200	4160
		1500	1650	1230	880	4410
		0835	1810	1340	950	5020
		0750	Unit start-up			
6-17	168	1700	Unit down			
		1250	1700	1320	960	4970
		0720	1690	1244	899	4840
6-16	167	1500	1700	1105	730	5550
		1240	Unit start-up			
		0905	Unit shut-down			
		0805	Acid flushed the membrane stack			
		0710	1720	1160	790	4760
6-15	166	1500	1630	1120	760	3980
		1400	Unit start-up			
		1100	Unit shut-down			
		1000	Bix flushed the membrane stack			
		0710	1710	1170	800	4720
6-14	165	1510	1740	1110	740	5540
		1330	1810	1130	735	5160
		1325	Unit start-up			
		1200	Unit shut-down			
		0930	Unit start-up			
6-13	164	0815	Unit shut-down			
		0715	Acid flushed the membrane stack			
		0700	Unit start-up			
		1800	Unit down			

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
6-11	162	1500	1730	1190	840	5120
		0735	Unit start-up			
		0713	Unit down			
		0702	1730	1180	840	5140
6-10	161	1430				
		0805				
6-9	160	1500	1870	1220	860	5380
		0706	1880	1270	880	5670
6-8	159	1515	1630	1030	670	5220
		1022	Unit start-up			
		0922	Unit shut-down			
		0750	Acid flushed the membrane stack			
6-7	158	0743	1890	1290	920	5500
		1530	1640	1160	790	5050
		0708	1760	1230	860	5170
6-4	155	1500	1750	1110	740	5620
		1245	Unit start-up			
		0815	Unit shut-down			
		0715	Acid flushed the membrane stack			
6-3	154	0705	1770	1330	960	4880
		1520	1720	1250	880	5040
		1000	1770	1340	990	4750
		0935	Unit start-up			
		0715	Unit down			
6-2	153	0700	1740	1280	870	5080
		1517	1780	1330	960	5000
		0747	1790	1350	970	4980
6-1	152	1511	1790	1230	850	5460
		1120	Tightened the membrane stack			
		1115	Unit start-up			
		0900	Unit shut-down			
		0800	Acid flushed the membrane stack			
		0724	1860	1430	1030	4960
5-28	148	1450	1670	1210	690	5000
		0800	Acid flushed the membrane stack			
		0745	1720	1220	870	4900
5-27	147	1500	1670	1180	830	5000
		0745	1800	1240	860	5200

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
5-26	146	1430	1710	1160	780	5300
		0823	1780	1160	790	5360
5-25	145	1435	1740	1155	700	5600
		1330	Unit start-up			
		1240	Hydraulic start-up			
		1000	Unit shut-down			
		0945	Acid flushed the membrane stack			
		0820	1775	1226	870	5200
5-24	144	1447	1700	1190	835	5000
		1100	1730	1235	855	5000
5-21	141	1315	1750	1190	750	5450
		1245	Unit start-up			
		1130	Hydraulic start-up			
		0830	Unit shut-down			
		0712	Acid flushed the membrane stack			
		0705	1860	1370	970	5450
5-20	140	1615	1740	1150	760	5150
		1230	1890	1210	870	5450
		0945	Unit start-up			
		0915	Unit down			
		0750	1770	1230	830	5450
5-19	139	0740	1770	1190	910	
5-18	138	2200				
		1530	1830	1180	780	
		1500	Unit start-up with one influent filter			
		1315	Acid flushed the membrane stack			
		0800	Biz flushed the membrane stack			
		0720	1800	1270	980	5160
5-17	137	1430	1810	1380	960	5300
		0745	1700	1300	900	5100
5-14	134	1444	1800	1190	820	
		1240	Unit start-up			
		0900	Acid flushed the membrane stack			
		0730	Unit shut-down			
		0720	1860	1360	1050	5300
5-13	133	1615	1723	1252	940	
		0730	1796	1330	971	
5-12	132	1440	1714	1236	877	5151
		0730	1799	1269	897	5387

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
5-11	131	1515	1765	1255	793	5284
		1330	Unit start-up			
		0910	Unit shut-down			
		0745	Acid flushed the membrane stack			
		0710	1798	1390	1056	4899
5-10	130	1541	1768	1331	968	4759
		0805	1854	1415	1054	4965
5-7	127	1430	1723	1267	864	5076
		0700	1808	1261	916	5559
5-6	126	1330				
5-5	125	0745				
5-4	124	1440	1706	1202	926	5240
		0730	1667	1210	877	5300
5-3	123	1515	1683	1112	801	5150
4-30	120	1540				
		1320	Unit start-up			
		1024	Acid flushed the membrane stack			
		0900	1778	1295	946	5034
4-29	119	1500				
		0920	1771	1318	959	5389
4-28	118	0750	1802	1251	872	5194
4-27	117	0808				
4-26	116	0900	Unit start-up			
4-23	113	1400	Unit shut-down			
		1300	Acid flushed the membrane stack			
		0845	Biz flushed the membrane stack			
		0745				
4-22	112	1545	1754	1295	903	5251
		0910	Unit start-up			
		0835	Unit shut-down			
		0830	1770	1305	951	4643
4-21	111	1410	Unit start-up			
		1320	Hydraulic start-up			
		1100	Unit shut-down			
		0945	Acid flushed the membrane stack			
		0816				
		0815	Unit start-up			
		0745	Unit shut-down			
		0744	1717	1251	930	4611

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	Concentrate Effluent
			Influent	First Stage Effluent	Second Stage Effluent	
4-20	110	1330	1696	1249	837	4860
		0915	Unit start-up			
		0815	Unit shut-down			
		0730	1799	1329	957	4925
4-19	109	1140				
		1040	Unit start-up			
		0706	Unit shut-down			
		0705	1863	1426	1079	4945
4-17	107	1600	1674	1210	841	4741
		1200	1717	1208	822	4770
		1130	Unit start-up			
		1037	Unit shut-down			
4-16	106	1030	1712	1348	996	4794
		0715	1787	1345	929	4340
4-15	105	1145	1695	1113	738	5200
		1030	Unit start-up			
		0930	Acid flushed the membrane stack			
		0745	1632	1272	933	4643
4-14	104	1130	1724	1265	905	4845
		0838	Unit start-up			
		0801	Unit shut-down			
		0745	1791	1295	916	5061
4-13	103	1500	Unit start-up			
		0800	Unit shut-down			
		0730	1750	1263	909	5184
		0900	1749	1207	816	5422
4-12	102	0820	Unit start-up			
		0745	Unit shut-down			
		0730	1760	1220	875	5000
		1500	1720	1097	707	5305
4-9	99	1215	Unit start-up			
		0815	Unit shut-down			
		0701	Acid flushed the membrane stack			
		0700	1793	1344	941	5115
4-8	98	1500	1810	1291	859	
		0815	1870	1333	913	5445
4-7	97	1415	1754	1230	842	5309
		0950	1826	1263	868	

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
4-6	96	1140	1685	1193	777	5724
		1115	Unit start-up			
		0930	Unit shut-down			
		0900	1901	1285	873	5206
4-5	95	1315	1778	1220	820	5500
		0800	1826	1264	836	6545
4-3	93	1485	1817	1082	732	5200
		1425	Unit start-up			
		1330	Hydraulic start-up			
		1200	Unit shut-down			
		1100	Biz flushed the membrane stack			
		1030	1760	1243	847	5610
4-2	92	1600	1652	1104	706	5437
		1400	Unit start-up			
		1030	Acid flushed the membrane stack			
		0920	1738	1272	880	5300
4-1	91	1510	1693	1217	792	5252
3-31	90	0950	1738	1309	780	5353
		0700	Unit start-up			
3-30	89	2100	Unit shut-down			
		0820	1838	1348	954	5198
3-29	88	2300	Unit start-up			
		1700	Unit shut-down			
		1350	1700	1212	864	5151
		1115	Unit start-up			
		1025	Unit shut-down			
		1024	1747	1314	946	4982
		0830	1766	1310	963	4922
3-27	86	1330				
		1329	Unit start-up			
3-26	85	1700	Unit shut-down			
		1500	1757	1175	801	5408
		1315	Unit start-up			
		1200	Unit shut-down			
		1130	1768	1214	801	5508
		1055	Unit start-up			
		1010	Hydraulic start-up			
		0736	Acid flushed the membrane stack			
		0735	1820	1296	974	5225

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
3-25	84	1430	1768	1212	811	5304
		1415				
		1340	Unit start-up			
		1140	Unit shut-down			
		1139	1841	1308	936	4982
		0740	1836	1352	982	5270
3-24	83	1515				
		1430	Unit start-up			
		1300	Unit shut-down			
3-23	82	0815	1866	1272	926	5393
		1330	1799	1298	818	5616
		1240	Unit start-up			
		0925	Acid flushed the membrane stack			
3-22	81	0815	1855	1403	1034	5062
		0830	1864	1518	1015	5162
3-20	79	1230	Unit start-up			
		1210	Unit shut-down			
		0910	1820	1326	944	5387
3-19	78	1430	1820	1248	842	5512
		0820	1848	1254	836	5720
		0700	Unit start-up			
3-18	77	2000	Unit shut-down			
		1100	1775	1268	835	5509
		1050	Unit start-up			
		0918	Unit shut-down			
3-17	76	0720	1820	1360	968	5232
		1445	1810	1300	915	5387
		0720	1831	1342	937	5390
3-16	75	0735	1862	1360	968	5241
3-15	74	1420	1768	1238	842	5322
		1100	Unit start-up			
		0900	Unit shut-down			
3-12	71	0720	1887	1379	985	5164
		1400	1728	1138	751	5512
		0825	Unit start-up			
		0800				
3-11	70	1515				
		1500	Hydraulic start-up			

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
3-9	68	1100	Unit shut-down			
3-8	67	1420				
		0830	Unit start-up			
		0800	Hydraulic start-up			
3-5	64	1445	Unit shut-down			
		1430				
		1330	Unit start-up			
		0930	Unit shut-down			
		0830	Acid flushed the membrane stack			
		0730				
3-4	63	1530				
		1500	Unit start-up			
		1430	Unit shut-down			
3-3	62	1420				
		0910	1747	1227	832	5179
3-2	61	1420	1738	1177	774	5307
		1330	Unit start-up			
		1220	Unit shut-down			
3-1	60	1240	1733	1150	733	5350
		1045	Unit start-up			
		0930	Unit shut-down			
2-26	57	1520	1733	1108	680	5460
		1419	Unit start-up			
		0930	Unit shut-down			
		0821	Acid flushed the membrane stack			
		0815	1808	1198	768	5198
2-25	56	1355	1594	1112	704	5243
2-24	55	1830				
		1730	Unit start-up			
		1530	Hydraulic start-up			
2-23	54	0851	Unit shut-down			
		0850	1804	1188	779	5412
2-22	53	1300	1782	1356	737	5610
		1100	Unit start-up			

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
2-19	50	1515	Unit shut-down			
		1500	1674	1188	708	5342
		1020	1739	1142	724	5324
		1007	Unit start-up			
		0907	Unit shut-down			
		0806	Acid flushed the membrane stack			
		0800	1762	1237	834	5413
		1450	1771	1199	799	5525
		0800	1785	1243	836	5537
		1500	1740	1078	729	4136
2-18	49	1430	Unit start-up			
		1530	Unit shut-down			
2-17	48	1400	Unit start-up			
		0930	Unit shut-down			
2-16	47	0815	Acid flushed the membrane stack			
		0800	1679	1162	821	5083
		1720	1622	1069	675	5260
2-11	42	1600	Unit start-up			
		0825				
		1814				
2-10	41	1530	Hydraulic operation only			
		1515				
		1420	Unit start-up			
		1200	Unit shut-down			
		0830	1752	1248	1040	4780
2-9	40	1140	1685	1143	745	5292
		1100	Unit start-up			
		1000	Unit shut-down			
2-8	39	0825	1716	1320	968	4620
		1700	1663	1156	704	4620
		1645	Unit start-up			
2-6	37	1545	Unit shut-down			
		1415	1674	1302	915	5000
		0810	1668	1242	840	5290
2-5	36	1520	1534	1026	680	5400
		1415	Unit start-up			
		0930	Unit shut-down			
2-4	35	0800	1520	1062	730	5232

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1971	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
2-3	34	1900	1695	1085	712	5729
		1750	1760	1158	757	5368
		1700	Unit start-up			
		0800	Unit shut-down			
2-2	33	1007				
		1006	Hydraulic start-up			
1-30	30	1200	Unit shut-down			
1-29	29	1430	1673	1244	862	5100
		0802	1705	1288	901	5162
1-28	28	1745	1632	1134	778	5184
		0836	1694	1155	807	5148
1-27	27	1550	1632	1214	668	5300
		1530				
		1529	Unit start-up			
1-15	15	1230	Unit shut-down			
		0923	Acid flushed the membrane stack			
		0830	1794	1331	903	5290
1-14	14	1530	1978	1403	955	5750
		1430	Unit start-up			
		0830	Biz flushed the membrane stack			
		0815	1760	1310	890	5400
1-13	13	1410	1780	1210	790	5480
		0955	Unit start-up			
		0900	Unit shut-down			
		0855	1810	1200	830	5470
1-12	12	1600	1880	1240	780	5520
		1430				
		1415				
		1410	Unit start-up			
		0800	Inspected membranes			
1-7	7	1400	Unit shut-down			
		0800	1730	1070	670	5440
		0730	Unit start-up			
1-6	6	1100	Hydraulic operation only			

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1970	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
12-18	352	1530	Unit shut-down			
		1500	1550	1020	740	4400
		1300	1590	1080	710	5040
		0720	1650	1100	740	5060
12-17	351	1500	1610	980	630	5470
		1330	1700	1020	630	5650
		1030	1720	1090	670	600
		0955	Unit start-up			
12-16	350	1000	Hand cleaned the membrane stack			
		0730	1640	1080	790	4960
12-15	349	1515	1580	1040	670	5090
		1400	1630	1620	1360	5180
		1345	Unit start-up			
12-14	348	1215	Unit shut-down			
		1030	1590	980	600	5520
		0930	Unit start-up			
12-10	344	1200	Unit shut-down			
		1145	1540	980	620	4530
		1130	Unit start-up			
		0600	Unit shut-down			
12-9	343	1500	Unit start-up			
		1305	Unit shut-down			
		1300	1570	850	580	4660
		1000	1550	1000	660	4770
		0930	Unit start-up			
11-12	316		Hand cleaned the membrane stack			
11-5	309	0900	Unit shut-down			
11-4	308	1500				
		1000	1650	1180	830	4890
11-2	306	1530	1580	1040	670	4880
		0730	1690	1220	870	5040
10-30	303	1530	1620	1000	620	5450
10-29	302	1000	1610	960	650	5300
10-28	301	1530	1620	880	560	5370
		1430	Unit start-up			
		0900	Unit shut-down			
		0700	Unit start-up			

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1970	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
10-27	300	2300	Unit shut-down			
		1500	1630	980	600	4800
		0730	1800		780	
10-26	299	1600				
		1000	1610	990	630	5240
		0955	Unit start-up			
10-21	294	1100	Biz flushed the membrane stack			
		1000	Acid flushed the membrane stack			
10-20	293	1400	Unit shut-down			
		0830	1600	1000	625	5150
10-19	292	0930	1370	810	615	4100
10-18	291	1500				
10-16	289	1000	1530	1080	740	4700
10-15	288	1000	1590	1070	740	4980
10-14	287	1500				
		1000	1730	1020	720	4640
		1130	1600	1000	650	5270
10-13	286	0830				
		0800	Unit start-up			
		1400	Unit shut-down			
10-12	285	0900				
		0830	Unit start-up			
		1400	Unit shut-down			
10-1	274	0835	1740	1140	780	5100
9-30	273	1530	Unit start-up			
		1430	Unit shut-down			
		0830				
9-29	272	0800	1530	1060	770	3700
		0900	Unit start-up			
8-28	240	0900	Unit shut-down			
		0800	1570	1040	690	5500
8-27	239	1500	1510	970	620	5110
		1200	1510	970	630	4800
		0800	1520	995	650	5020
8-26	238	1400	1440	980	620	5340
		1300	Unit start-up			
		0700	Hydraulic start-up			

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1970	Day	Time	micromhos/cm at 25°C		Diluting Stream	Concentrate
			Influent	First Stage Effluent	Second Stage Effluent	Effluent
8-25	237	1500	Unit shut-down			
		1300	Hydraulic start-up			
8-24	236	0700	Unit shut-down			
		1530	1560	970	610	4750
		1230	1540	1010	630	5400
		0945				
		0900	1590	1020	650	5270
		0845	Unit start-up			
8-21	233	1500	Hydraulic start-up			
		0915	Unit shut-down			
		0845				
		0800	1690	1130	735	5400
8-20	232	1500	1480	950	625	3850
		1430	Unit start-up			
		1300	Unit shut-down			
		1200	1480	1020	680	5080
		0900				
		0800	1660	1000	740	5420
8-19	231	1530	Unit start-up			
		1500	Unit shut-down			
		1200	1570	1130	660	5640
		0900	1630	1090	720	5320
8-18	230	2400	Unit start-up			
		2200	Unit shut-down			
		1500	1510	960	590	4730
		1445	Unit start-up			
		1430	Unit shut-down			
		1200	1550	1000	630	5210
		0900				
		0800	1480	990	640	5110
8-17	229	1500	1440	900	560	4860
		1300	1440	930	570	5700
		1000				
		0900	1490	970	640	4770
8-14	226	1500	1530	950	590	5250
		0830				
		0800	1600	1010	650	5300

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1970	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
8-13	225	1530	1480	905	540	4990
		1400	Unit start-up			
		1000	Unit shut-down			
8-12	224	0835				
		0800	1580	940	615	4880
		1500	1540	960	590	5080
		1200	1530	985	600	4080
8-11	223	0800	1580	1010	640	5140
		1500	1510	940	580	4980
		1300	1510	935	590	4960
		1200	Unit start-up			
8-10	222	1000	Unit shut-down			
		0800	1490	1020	650	4370
		1500	1590	1000	630	4460
		1300	1570	1050	670	4410
8-9	221	0930				
		0800	1610	1010	660	4420
8-7	219	1500				
		1200	1630	1060	680	4760
		1015				
8-6	218	0800	1540	1120	720	
		1500	1540	960	620	
		1300	1540	930	640	
		1255	Unit start-up			
		1245	Unit shut-down			
8-5	217	0830	1850			
		0800	1370	1027	660	
		1615				
		1200				
		1155	Unit start-up			
8-4	216	1100	Unit shut-down			
		0900	1620	1011	740	
		0830				
		1510	1700	1110	690	
		1501				
		1500	Unit start-up			
		0830	Hand cleaned the membrane stack			
		0800	1680	1330	970	

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCE AND
PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1970	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
8-3	215	1500	1570	1210	800	
		1200	1590	1240	860	
		0800	1580	1190	860	
8-2	214	1300				
7-31	212	1300	1640	1090	730	
		0800	1610	1140	800	
7-30	211	1500	1520	945	640	
		1100	Unit start-up			
7-29	210	2300	Unit shut-down			
		1200	1550	1010	660	
		1000	1520	1020	660	
		0830				
7-28	209	0730	Unit start-up			
		0700	Hand cleaned the membrane stack			
7-27	208	1530	Unit start-up			
		1330	Unit shut-down			
		0900				
		0800	1600	990	640	
7-24	205	0800	1560	1090	735	
7-23	204	1500	1460	1040	680	
		0806				
7-22	203	0800	1540	1060	705	
		1500	1470	950	600	
		1200	1500	960	610	
		0900	1540	1000	620	
7-21	202	0840				
		1200	1530	960	600	
		0900	1530	940	620	
7-20	201	0840				
		1130	1530	1530	580	
		0800				
7-17	198	0730	1530	1020	640	
		1500	1540	970	610	
		1400	1560	970	580	
		1300	1580	1570	610	
		0900	1580	1020	620	
		0830				

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1970	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
7-16	197	1500	1570	960	590	
		1400	1470	970	580	
		1300	1550	970	580	
		1200	1590	980	600	
		1000	1600	1010	630	
		0900	1630	1040	650	
	7-15	196	0900			
	7-14	195	1500	Unit start-up		
			0800	Hand cleaned the membrane stack		
			0755			
	7-13	194	0830			
	7-10	191	0800	1850		
	7-9	190	1530	1900		
			1525	Unit start-up		
			1500	Unit shut-down		
			0800	Unit start-up		
			0700	Unit shut-down		
7-8	189	1530	1800			
		1500	Unit start-up			
		0900	Hand cleaned the membrane stack			
	7-6	187	0920			
	7-3	184	0800			
			0700	Unit start-up		
	7-1	182	1530	Unit shut-down		
			1100			
	6-30	181	1000	Unit start-up		
			0900	Unit shut-down		
			0840			
	6-29	180	0900			
	6-26	177	0830	1800		
	6-25	176	0800			
	6-24	175	1500			
			1455	Unit start-up		
			0700	Hand cleaned the membrane stack		
6-23	174	1230	Unit start-up			
		1100	Unit shut-down			
		0800				

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1970	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
6-22	173	0930				
6-21	172	1300				
6-20	171	1000				
6-18	169	1030				
6-17	168	0900				
		0800		Unit start-up		
6-16	167	1330		Hydraulic operation only		
		0830				
6-15	166	0900				
6-14	165	1120				
6-13	164	1100				
6-12	163	1030				
6-11	162	1530		Unit start-up		
		0800		Hand cleaned the membrane stack		
6-9	160	0900				
		0800		Unit start-up		
6-8	159	0800		Hydraulic operation only		
6-5	156	0840				
6-4	155	0800				
6-3	154	0900				
6-2	153	0900				
6-1	152	0730		1800		
		0700		Unit start-up		
		2400		Unit shut-down		
5-30	150	1030		1950		
5-28	148	1500		1900		
		1455		Unit start-up		
		0720		Unit shut-down		
5-25	145	0800		Unit start-up		
5-22	142	0730		Hand cleaned the membrane stack		
		0720				
5-21	141	1100				
5-20	140	1200				
5-19	139	0900		2000		
		0855		Tightened the membrane stack		
5-18	138	0705		1620		
		0700		Tightened the membrane stack		
5-17	137	1120		1802		

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1970	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
5-16	136	1130	1800			
5-15	135	0800	1850			
5-14	134	0900	1850			
5-13	133	0900	1890			
5-12	132	1500	1850			
5-11	131	0800	1850			
5-10	130	1000	1850			
5-9	129	0940	1850			
5-8	128	1330	1850			
		1000	1850			
5-7	127	0930	1850			
		0925	Unit start-up			
		0900	Unit shut-down			
5-6	126	1530	Unit start-up			
		1000	Hand cleaned the membrane stack			
		0930	1850			
5-5	125	0815				
5-4	124	1400	1850			
		1000	1850			
		0955	Unit start-up			
4-27	117	1300	Unit shut-down			
		0700				
4-24	114	0800				
4-23	113	0700				
4-22	112	1330				
		0900				
4-21	111	1330				
		0900	1850			
4-20	110	1410	1800			
		1330	Unit start-up			
		1300	Unit shut-down			
		0900	1800			
		0830	Unit start-up			
		0700	Unit shut-down			
4-17	107	1500				
		1330				
		0900				

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND
PH'S FROM GRAB SAMPLES, PART 1 (CONTINUED)

1970	Day	Time	micromhos/cm at 25°C		Diluting Stream	
			Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
4-16	106	1500				
		1230				
		0900				
4-15	103	1500	1750			
		1230	1750			
		0900	1750			
		0700	Unit start-up			
4-14	104		Unit shut-down			
4-13	103	1400	Unit start-up			
		1335	Unit shut-down			
		1330	1800			
		0700	Unit start-up			
3-20	79	1130	Unit shut-down			
		1030				
		1000	Unit start-up			
		0700	Unit shut-down			
3-19	78	1500				
		1200				
		0800				
3-18	77	1500				
		1200				
		0800				
3-17	76	1500				
		1200				
		0800				
3-16	75	1500				
		1200				
		1130	Unit start-up			
		0815	Unit shut-down			
		0800				
3-14	73	0830				
3-13	72	1500				
		1200				
		0800				
3-12	71	1500				
		1200				

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND
PH'S FROM GRAB SAMPLES, PART 2

1971 Day	Time	pH D i l u t i n g S t r e a m				Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	
183	1340					
	1320					
	0930					
182	0737	8.9		8.0		
	1500	7.6		7.0		
	0720	8.0		7.1		
181	1312					
	1312	7.7		7.1		
	0735	7.6		6.9		
180	1430	7.9		6.8		
	1415					
	1330					
179	0715	8.2		7.4		
	1430	8.1		7.3		
	0930	7.9	7.8	7.5	5.8	
176	0915					
	0740					
	0735					
175	1530					
	1525					
	0710					
174	0707	8.6		8.1		
	1520	8.5		7.4		
	1500					
173	1435					
	1400					
	1355					
172	1200					
	1000	8.8		8.5		
	0732	8.8		8.4		
171	1530	7.9		7.4		
	1445					
	0930					
170	0730					
	0705	8.1		7.3		

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1971 Day	Time	pH Diluting Stream			Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
173	1515	8.0		7.5	
	1445				
	1400				
	1300				
	0710	8.2		7.4	
172	1500	8.2		7.3	
	1445				
	1200				
	0930				
	0830				
169	0730				
	0715	8.2		7.9	
	1500	8.3		7.4	
	0835	8.2		7.5	
	0750				
168	1700				
	1250	8.6		7.9	
	0720	8.6		7.9	
167	1500	8.3		8.3	
	1240				
	0905				
	0805				
	0710	8.3		7.5	
166	1500	8.2		7.5	
	1400				
	1100				
	1000				
	0710	7.9		7.3	
165	1510	8.1		7.1	
	1330	8.1		7.4	
	1325				
	1200				
	0930				
164	0815				
	0715				
	0700				
	1800				

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND
PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1971 Day	Time	pH D i l u t i n g S t r e a m			Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
162	1500	7.9		7.8	
	0736				
	0713				
	0702	8.0		7.6	
161	1430				
	0805				
160	1500	7.8		7.2	
	0706	8.0		7.6	
159	1515	7.8		6.5	
	1022				
	0922				
	0750				
158	0743	8.0		7.4	
	1530	8.2		7.6	
	0708	8.2		7.8	
	1500	7.9		7.2	
155	1245				
	0815				
	0715				
	0705	7.8		7.6	
154	1520	7.8		7.2	
	1000	7.7		7.4	
	0935				
	0715				
153	0700	7.8		7.3	
	1517	8.2		7.3	
	0747	8.5		7.7	
152	1511	8.0		7.7	
	1120				
	1115				
	0900				
	0800				
148	0724	8.0		7.8	
	1450	8.2		8.0	
147	0800				
	0745	8.2		8.0	
	1500	7.6		7.1	
	0745	7.7		7.0	

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1971 Day	Time	pH D i l u t i n g S t r e a m				Cathode Stream	
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	Influent	
146	1430	7.5		6.9			
	0823	7.6		7.0			
145	1435	7.2		6.6			
	1330						
	1240						
	1000						
	0945						
144	0820	7.4		6.8			
	1447	7.6		7.6			
	1100	7.9		7.7			
141	1315	7.7		6.8			
	1245						
	1130						
	0830						
	0712						
140	0705	7.8		7.3			
	1615	8.2		7.7			
	1230	7.6		7.5			
	0945						
	0915						
139	0750	7.5		7.5			
	0740	7.8		7.7			
138	2200						
	1530	8.0		7.9			
	1500						
	1315						
	0800						
137	0720	8.0		7.9			
	1430	7.6		7.5			
	0745	7.5		7.4			
134	1444	7.6		7.5			
	1240						
	0900						
	0730						
133	0720	7.7		7.6			
	1615	7.9					
	0730	8.0		7.0			
132	1440	7.7		7.4	5.5	1.2	
	0730	7.8	7.7	7.6	5.5	1.2	

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1971 Day	Time	pH D i l u t i n g S t r e a m				Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	
131	1515	7.5	6.7	7.1	5.8	
	1330					
	0910					
	0745					
	0710	7.8	7.7	7.6	5.5	
130	1541	7.8	7.8	7.7	6.1	
	0805	8.0	8.0	7.9	6.0	
127	1430	7.8	7.75	7.7	6.4	
	0700	7.6	7.6	7.6	6.2	
126	1330					
125	0745					
124	1440	7.2	7.15	7.0	5.4	
	0730	7.2	7.1	7.0	5.7	1.3
123	1515	7.0	6.8	6.6	5.6	
120	1540					
	1320					
	1024					
	0900	7.2	7.2	7.0	5.5	1.1
119	1500	7.9	7.9	7.6		1.2
	0920	7.9	7.8	7.6	5.7	1.1
118	0750	7.4	7.2	7.0	5.4	1.0
117	0808					
116	0900					
113	1400					
	1300					
	0845					
	0745					
112	1545	8.0	7.7	7.5	5.7	
	0910					
	0835					
	0830	7.9	7.6	7.5	5.4	
111	1410					
	1320					
	1100					
	0945					
	0816					
	0815					
	0745					
	0744	8.2	8.0	7.8	5.7	

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1971 Day	Time	pH Diluting Stream				Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	
110	1330	7.5	7.1	6.8	5.3	1.0
	0915					
	0815					
	0730	7.7	7.4	7.2	5.4	1.1
109	1140					
	1040					
	0706					
	0705	7.8	7.6	7.4	5.7	0.8
107	1600	7.8	7.5	7.1	5.5	0.9
	1200	7.8	7.4	6.9	5.4	0.8
	1130					
	1037					
	1030	7.8	7.6	7.4	5.5	0.9
106	0715	7.8	7.7	7.3	5.4	0.9
105	1145	7.9	7.4	7.0	5.5	0.0
	1030					
	0930					
	0745	7.9	7.6	7.3	5.4	0.9
104	1130	8.3	8.2	7.8	6.0	
	0838					
	0801					
	0745	8.0	7.9	7.8	5.7	1.5
103	1500					
	0800					
	0730	7.7	7.3	7.1	5.5	1.5
102	0900					
	0820					
	0745					
	0730	7.3	7.2	6.9	5.7	1.5
99	1500	7.6	7.3	6.9	5.6	1.5
	1215					
	0815					
	0701					
	0700	7.5	7.3	7.1	5.3	1.5
98	1500	7.4	7.2	7.0	5.3	1.5
	0815	7.5	7.4	7.1	5.5	1.5
97	1415	7.4	7.2	6.9	5.4	1.5
	0950	7.5	7.3	7.0	5.8	1.5

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1971 Day	Time	pH Diluting Stream				Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	
96	1140	7.2	7.1	6.8	5.3	1.3
	1115					
	0930					
	0900	7.4	7.1	6.9	5.7	1.2
95	1315					
	0800	7.2	7.1	6.7	5.2	1.5
93	1435	7.6	6.7	6.2	2.9	1.5
	1425					
	1330					
	1200					
	1100					
	1030	7.6	7.3	7.1	5.4	1.5
92	1600	8.0	7.7	7.6	6.5	1.5
	1400					
	1030					
	0920	7.6	7.4	7.3	6.0	1.5
91	1510	7.7	7.3	7.1	5.9	1.5
90	0950	7.4	7.1	6.9	6.9	1.5
	0700					
89	2100					
	0820					
88	2300					
	1700					
	1350					
	1115					
	1025					
	1024	7.2	6.9	6.7	4.9	1.5
	0830	7.1	6.9	6.9	4.7	1.5
86	1330					
	1329					
85	1700					
	1500	7.5	7.4	7.1	5.5	1.5
	1315					
	1200					
	1130					
	1055					
	1010					
	0736					
	0735	7.5	7.3	7.2	5.7	1.5

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PAFT 2 (CONTINUED)

1971 Day	Time	pH D i l u t i n g S t r e a m				Cathode Stream Influent
		Influent	Effluent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
84	1430	7.5	7.2		7.0	5.2
	1415					
	1340					
	1140					
	1139	7.3	7.3		7.2	6.0
83	0740					
	1515					
	1430					
	1300					
	0815	7.5	7.2		7.0	5.4
82	1330	7.4	7.2		6.8	5.5
	1240					
	0925					
	0815					
	0830	7.8	7.6		7.5	5.5
81	1230					
	1210					
	0910	7.8	7.7		7.4	5.8
	1430	7.3	7.3		7.1	5.5
	0820	7.5	7.4		7.2	5.5
78	0700					
	2000					
	1100	7.8	7.4		7.2	5.5
	1050					
	0918					
76	0720	7.3	7.1		6.8	4.6
	1445	7.8	7.5		7.2	6.0
	0720	7.5	7.4		7.0	5.8
	0735	7.5	7.5		7.2	6.0
	1420	7.5	7.3		7.1	6.1
75	1100					
	0900					
	0720	7.6	7.5		7.3	6.6
	1400	7.7	7.4		7.1	6.0
	0825					
74	0800					
	1515					
	1500					

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1971 Day	Time	pH Diluting Stream				Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	
68	1100					
67	1420	7.7	7.3	7.0	5.7	1.5
	0830					
	0800					
64	1445					
	1430	7.4	7.1	6.6	5.4	1.6
	1330					
	0930					
	0830					
	0730	7.5	7.1	6.8	5.6	1.6
63	1530	7.3	7.0	6.6	5.0	1.4
	1500					
	1430					
62	1420					
	0910	7.4	7.1	6.8	5.6	1.6
61	1420	7.4	7.3	7.0	5.9	1.5
	1330					
	1220					
60	1240	7.7	7.7	7.4	6.3	1.5
	1045					
	0930					
57	1520	7.6	7.4	7.1	5.9	1.5
	1419					
	0930					
	0821					
	0815	7.5	7.3	7.0	5.8	1.6
56	1355	7.4	7.0	6.8	5.7	1.5
55	1830					
	1730					
	1530					
54	0851					
	0850	7.5	7.5	7.4	6.2	1.5
53	1300	7.3	6.9	6.9	5.8	1.5
	1100					

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1971 Day	Time	pH Diluting Stream				Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	
50	1515					
	1500	7.5	7.3	7.1	5.8	1.6
	1020	7.6	7.3	7.0	5.9	1.6
	1007					
	0907					
	0806					
	0800	7.5	7.3	7.0	5.7	1.5
49	1450	7.8	7.5	7.2	5.8	1.5
	0800	7.9	7.7	7.5	5.7	1.5
48	1500	8.4	8.1	7.8	6.1	1.5
	1430					
47	1530					
	1400					
42	0930					
	0815					
41	0800	8.5	8.4	8.0	5.5	1.5
	1720	7.9	7.5	7.1	5.5	1.6
40	1600					
	0825					
	1814					
	1530					
	1515					
	1420					
	1200					
39	0830	8.9	8.7	8.6	5.6	1.9
	1140	8.8	8.8	8.4	5.0	1.7
	1100					
	1000					
37	0825	8.8	8.7	8.5	4.5	1.7
	1700	8.9	9.1	8.6	5.2	1.5
	1645					
36	1545					
	1415	9.6	9.5	9.4		1.6
	0810	9.6	9.6	9.4	4.0	1.8
35	1520	9.7	9.6	9.3	5.5	1.7
	1415					
	0930					
	0800	9.5	9.4	9.2	5.2	1.7

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1971 Day	Time	pH Diluting Stream				Cathode Stream Influent
		Influent	Effluent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
34	1900	9.1	9.0	8.7	5.4	1.7
	1750	9.2	9.1	8.9	5.7	1.9
	1700					
	0800					
33	1007					
	1006					
30	1200					
29	1430	9.1	9.1	8.9		1.5
	0802	9.2	9.1	8.9	5.5	1.8
28	1745	9.2	9.1	8.6	4.9	1.8
	0836	9.3	9.1	8.9	5.2	1.8
27	1550	8.9	8.9	8.6	4.5	
	1530					
	1529					
15	1230					
	0923					
	0830	8.0	7.8	7.3	3.3	
14	1530	8.1	7.8	7.3	3.9	1.3
	1430					
	0830					
13	0815	7.7	7.6	7.2	3.6	1.3
	1410	8.2	7.7	7.3	5.4	
	0955					
	0900					
12	0855	8.4	7.9	7.5	6.2	1.5
	1600	8.4	8.2	7.8	6.3	1.5
	1430					
	1415					
	1410					
7	0800					
	1400					
	0800	8.3	8.1	7.6	3.1	1.5
6	0730					
	1100					

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1970 Day	Time	pH D i l u t i n g S t r e a m				Cathode Stream Influent
		Influent	Effluent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
352	1530					
	1500	9.1	9.0	8.9	6.2	1.4
	1300	9.3	9.1	8.8	4.8	1.4
	0720	9.1	8.9	8.8	6.1	1.4
351	1500	9.1	9.0	8.7	5.9	
	1330	8.9	8.9	8.6	3.7	
	1030	8.9	8.8	8.6	4.0	1.5
	0955					
350	1000					
	0730	9.1	8.9	8.8	6.3	
349	1515	8.7	8.7	8.4		1.6
	1400	9.0	8.8	8.8		1.6
	1345					
348	1215					
	1030	8.5	8.5	7.8	3.7	1.6
	0930					
344	1200					
	1145	9.2	9.2	8.9	5.9	
	1130					
	0600					
343	1500					
	1305					
	1300	8.8	8.5	7.7	5.7	1.7
	1000	8.5	8.0	7.5	5.4	1.4
	0930					
316						
309	0900					
308	1500	7.5	7.2	6.9	4.1	1.7
	1000	7.5	7.1	6.9	5.7	1.7
306	1530	7.3	6.9	6.7	5.3	1.5
	0730	7.3	7.1	6.9	5.7	2.0
303	1530	7.1	6.9	6.5	5.5	
302	7.0	6.8	6.6	5.7		
301	1530	6.7	6.4	6.2	5.3	1.8
	1430					
	0900					
	0700					

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1970 Day	Time	pH D i l u t i n g S t r e a m			Concentrate Effluent	Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent		
300	2300					
	1500		6.9	6.6	6.5	1.9
	0730		6.9	6.6		1.9
299	1600					
	1000	7.0	6.8	6.6		
	0955					
294	1100					
	1000					
293	1400					
	0830	7.1	6.7	6.4	4.9	1.5
292	0930	7.1	6.8	6.5	4.9	1.7
291	1500				4.5	1.3
289	1000	7.4	7.1	6.8	4.9	1.7
288	1000	7.3	7.2	6.9	5.1	1.8
287	1500				5.0	1.5
	1000	7.3	7.1	6.8	5.1	1.7
286	1130	7.1	6.8	6.5	4.9	1.5
	0830	7.2	6.7	6.6	4.7	1.6
	0800					
285	1400					
	0900					
	0830					
274	1400					
	0835	7.4	7.1	6.8	4.3	1.7
273	1530					
	1430					
	0830				5.0	1.5
	0800	7.7	7.4	7.3	4.4	1.7
272	0900					
240	0900					
	0800	6.8	6.5	6.2	3.0	1.4
239	1500	7.4	7.1	6.8	4.8	1.4
	1200	7.4	7.1	6.8	4.7	1.5
	0800	6.9	6.6	6.3	3.7	1.5
238	1400	7.3	7.1	6.7	4.9	1.6
	1300					
	0700					

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1970 Day	Time	pH D i l u t i n g S t r e a m				Cathode Stream Influent
		Influent	Effluent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent
237	1500					
	1300					
	0700					
236	1530	7.2	6.9	6.6	4.8	1.2
	1230	7.3	7.0	6.7	4.9	1.3
	0945				5.0	1.2
	0900	7.2	7.0	6.7	5.2	1.5
	0845					
233	1500					
	0915					
	0845				5.5	1.5
232	0800	6.8	6.5	6.3	4.5	1.5
	1500	6.8	6.5	6.2	6.6	1.5
	1430					
	1300					
	1200	7.3	7.0	6.7	3.5	1.2
231	0900					
	0800	7.1	6.8	6.5	5.0	1.4
	1530					
	1500					
	1200	7.1	6.8	6.5	2.7	1.5
230	0900	6.7	6.4	6.2	6.7	1.6
	2400					
	2200					
	1500	7.1	6.8	6.5	5.5	1.5
	1445					
	1430					
	1200	7.1	6.8	6.5	5.5	1.4
	0900				5.2	1.0
	0800	6.5	6.2	5.9	5.0	1.4
	1500	7.1	6.8		5.5	1.5
229	1300	7.1	6.7	6.4	2.7	1.4
	1000				5.4	1.2
	0900	7.1	6.8	6.5	4.3	1.8
	1500	7.5	7.3	7.3	3.7	1.5
226	0830				5.0	1.5
	0800	6.4	6.1	6.1	5.0	1.6

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES
AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1970 Day	Time	pH Diluting Stream				Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	
225	1530	6.9	6.6	6.3	3.6	1.4
	1400					
	1000					
	0835				5.2	1.5
	0800	6.7	6.4	6.2	6.3	1.7
224	1500	7.0	6.7	6.5	5.0	1.4
	1200	7.0	6.7	6.4	5.0	1.4
	0800	6.8	6.5	6.3	5.8	1.6
	1500	7.1	6.8	6.5	5.4	1.5
223	1300	7.1	6.7	6.4	5.9	1.5
	1200					
	1000					
	0800	6.5	6.3	6.0	5.2	1.6
	1500	7.1	6.8	6.6	5.8	1.5
222	1300	7.1	6.8	6.3	5.7	1.5
	0930				5.0	1.2
	0800	7.0	6.7	6.3	4.9	1.5
	1500				5.3	1.8
	1200	7.2	6.9	6.6	3.3	1.1
219	1015				5.0	1.7
	0800	7.1	6.9	6.7	6.2	1.6
	1500	7.3	6.9	6.7	4.6	1.4
	1300	7.2	7.0	6.7	3.8	1.4
	1255					
218	1245					
	0830				5.3	1.8
	0800	6.8	6.6	6.3	5.1	1.4
	1615				4.0	1.5
	1200					
217	1155					
	1100					
	0900	7.5	7.3	7.0	5.6	1.7
	0830				5.3	1.8
	1510	7.8	7.5	7.2	5.5	1.5
216	1501				5.0	1.5
	1500					
	0830					
	0800	7.7	7.4	7.4	5.5	1.5

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1970 Day	Time	pH D i l u t i n g S t r e a m				Cathode
		Influent	Effluent	Effluent	Concentrate Effluent	Stream
						Influent
215	1500	7.7	7.4	7.1	5.5	1.7
	1200	7.9	7.5	7.2	5.5	1.7
	0800	7.9	7.5	7.2	5.4	1.6
214	1300				5.0	1.8
212	1300	8.4	8.2	8.1	4.0	1.5
	0800	7.8	7.4	7.0	5.7	1.7
211	1500	7.9	7.1	7.0		
	1100					
210	2300					
	1200	7.4	7.1	6.8	5.8	1.6
	1000	7.4	7.0	6.7	5.9	1.6
	0830				4.5	1.5
	0730					
209	0700					
208	1530					
	1330					
	0900				5.3	1.8
	0800	7.3	6.9	6.6	5.8	1.7
205	0800	7.7	7.2	6.9		
204	1500	6.5	6.4	6.3	4.6	2.2
	0806				5.3	1.7
	0800	7.6	7.2	6.9	3.6	1.8
203	1500	7.3	7.0	6.7	4.2	1.9
	1200	7.4	7.0	6.7	4.8	1.8
	0900	7.4	7.0	6.7	4.5	1.8
	0840				5.5	1.8
202	1200	7.1	6.8	6.6	3.1	1.7
	0900	7.0	6.8	6.5	3.1	1.8
	0840				5.5	1.8
201	1130	7.1	6.8	6.7	5.2	1.9
	0800				5.5	1.8
	0730	7.1	6.9	6.7	4.0	1.9
198	1500	7.0	6.8	6.5		
	1400	7.0	6.8	6.5		
	1300	7.1	7.0	6.5	4.5	1.9
	0900	7.2	6.8	6.6	5.0	1.8
	0830				5.0	1.8

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1970 Day	Time	pH D i l u t i n g S t r e a m				Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	
197	1500	7.1	6.9	6.6	5.5	1.8
	1400	7.5	6.9	6.7		
	1300	7.1	6.9	6.6	4.5	1.8
	1200	7.1	6.9	6.6		
	1000	7.0	7.1	6.5		
	0900	7.0	6.7	6.5	5.3	
196	0900				5.0	2.0
195	1500					
	0800					
	0755				5.0	1.8
194	0830				5.0	1.8
191	0800				5.5	1.5
190	1530				5.5	1.5
	1525					
	1500					
	0800					
	0730					
189	1530				3.5	1.5
	1500					
	0900					
187	0920				5.0	1.9
184	0800				5.5	1.7
	0700					
182	1530					
	1100				5.5	1.7
181	1000					
	0900					
	0840				5.5	2.0
180	0900				5.5	1.7
177	0830				5.5	1.5
176	0800				5.5	1.7
175	1500				5.5	1.5
	1455					
	0700					
	1230					
174	1100					
	0800				5.5	1.6

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1970 Day	Time	pH D i l u t i n g S t r e a m			Concentrate Effluent	Cathode Stream Influent
		Influent	First Stage Effluent	Second Stage Effluent		
173	0930				5.5	1.6
172	1300				5.3	1.5
171	1000				5.3	1.5
169	1030				5.3	1.6
168	0900				5.3	1.5
	0800					
167	1330					
	0830				5.5	1.5
166	0900				5.5	1.5
	1120				5.5	1.5
164	1100				5.5	1.5
163	1030				5.5	1.5
162	1530					
	0800					
160	0900				5.5	1.5
	0800					
159	0800					
156	0840				5.5	1.5
155	0800				5.5	1.5
154	0900				5.5	1.5
153	0900				5.5	1.5
152	0730				5.5	1.5
	0700					
	2400					
150	1030				5.5	1.5
148	1500				5.5	1.5
	1455					
	0720					
145	0800					
142	0730					
	0720				5.5	1.1
141	1100				5.1	1.0
140	1200				5.5	1.0
139	0900				5.5	1.0
	0855					
138	0705				5.4	1.2
	0700					
137	1120				5.5	0.0

TABLE B-4 ELECTRODIALYSIS DEMINERALIZATION STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1970 Day	Time	pH D i l u t i n g S t r e a m			Cathode Stream	
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	Influent
136	1130				5.5	1.5
135	0800				5.4	1.5
134	0900				5.0	1.0
133	0900				5.5	1.0
132	1500				6.0	2.0
131	0800				5.5	2.0
130	1000				5.6	0.9
129	0940				5.6	0.9
128	1330				5.5	1.0
	1000				5.5	1.0
127	0930				5.5	1.5
	0925					
	0900					
126	1530					
	1000					
	0930				5.5	1.1
125	0815				5.6	1.8
124	1400				5.6	1.0
	1000				5.0	1.1
	0955					
117	1300					
	0700				5.2	1.0
114	0800				5.2	1.0
113	0700				5.2	1.0
112	1330				5.0	1.4
	0900				5.2	1.5
111	1330				5.0	1.5
	0900				5.5	1.5
110	1410				3.0	1.5
	1330					
	1300					
	0900				5.5	1.5
	0830					
	0700					
107	1500				5.5	1.8
	1330				5.5	2.0
	0900				5.5	2.0

TABLE B-4 ELECTRODIALYSIS DEMINERALIZER STREAM CONDUCTANCES AND PH'S FROM GRAB SAMPLES, PART 2 (CONTINUED)

1970 Day	Time	pH D i l u t i n g S t r e a m			Cathode Stream	
		Influent	First Stage Effluent	Second Stage Effluent	Concentrate Effluent	Influent
106	1500				5.5	1.6
	1230				5.3	1.0
	0900				5.3	1.6
103	1500				5.3	1.0
	1230				5.7	1.0
	0900				5.4	1.0
	0700					
104						
103	1400					
	1335					
	1330				5.5	1.0
	0700					
79	1130					
	1030				5.0	1.0
	1000					
	0700					
78	1500				4.7	1.6
	1200				4.8	1.7
	0800				4.7	2.0
77	1500				5.5	1.5
	1200				5.0	1.6
	0800				5.5	1.7
76	1500				5.5	1.6
	1200				5.5	1.8
	0800				4.0	2.0
					5.0	1.0
75	1500				5.5	1.5
	1200					
	1130					
	0815					
	0800				5.5	1.5
73	0830				5.1	1.5
72	1500				5.0	1.5
	1200				5.8	1.2
	0800				5.5	1.0
71	1500				5.0	1.0
	1200				5.3	1.0

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
7-2	183	1340	49				
		1320	Unit start-up				
		0930	Acid flushed the membrane stack				
		0737	58			17.50	
7-1	182	1500	85			24.75	
		0720	97			28.75	
6-30	181	1312	Started sand filter influent				
		1312	126			39.00	
		1140	128	80	9.35		2
		0735	54			15.75	
6-29	180	1430	80			23.5	
		1415	Unit start-up				
		1330	Unit shut-down				
		0715	98			27.00	
6-28	179	1445	53	72	8.00	10.50	2
		1430	53			10.75	
		0930	62			12.00	
		0915	Unit start-up				
		0735	Hydraulic start-up				
6-25	176	1530	Unit shut-down				
		0710	Hand cleaned the membrane stack				
		0707	104			13.25	
6-24	175	1520	128			20.25	
		1515	59	69	7.95		
		1500	Unit start-up				
		1435	Unit shut-down				
		1400	Acid flushed the membrane stack				
		1000	68			21.00	
		0732	77			21.25	
6-23	174	1530	102			29.25	
		1445	Unit start-up				
		0930	Unit shut-down				
		0730	EDTA flushed the membrane stack				
		0705	104			27.00	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
6-22	173	1515	127		34.00	
		1445	Unit start-up			
		1415	58	70	7.35	10.00
		1400	Unit shut-down			2
		1300	Acid flushed the membrane stack			
		0710	68		14.00	
6-21	172	1500	94		21.00	
		1445	Unit start-up			
		1200	Unit shut-down			
		0930	Unit start-up			
		0830	Unit shut-down			
		0730	Acid flushed the membrane stack			
		0715	106		24.25	
6-18	169	1500	205		55.00	
		1445	60	145	15.40	7.00
		0835	69			4
		0750	70	8.80		
6-17	168	1700	Unit shut-down			
		1250	127		18.50	
		1145	58	70	8.50	
		0720	65		22.50	
6-16	167	1500	89		30.00	
		1330			6.00	2
		1240	Unit start-up			
		0905	Unit shut-down			
		0805	Acid flushed the membrane stack			
		0710	98		13.00	
6-15	166	1500	122		20.50	
		1450	46	76	7.30	
		1400	Unit start-up			
		1100	Unit shut-down			
		1000	Biz flushed the membrane stack			
		0710	52		21.75	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
6-14	165	1510	78			30.25	
		1330	80			31.00	
		1325	Unit start-up				
		1200	Unit shut-down				
		0930	Unit start-up				
		0815	Unit shut-down				
		0720	23	72	8.35		
		0715	Acid flushed the membrane stack				
		0700	Unit start-up				
6-13	164	1800	Unit shut-down				
6-11	162	0736	Unit start-up				
		0720	94	71	9.20	0.00	5
		0713	Unit shut-down				
		0702	94			7.00	
6-10	161	1430	50	70	9.80	14.75	
		0805	58			17.50	
6-9	160	1500	84			26.50	
		0710				9.50	2
		0706	97			9.50	
6-8	159	1520	49	70	8.40		
		1515	49			17.25	
		1022	Unit start-up				
		0922	Unit shut-down				
		0750	Acid flushed the membrane stack				
		0743	58			20.00	
6-7	158	1530	82			27.00	
		0820	20	73	8.00		
		0708	20			31.00	
6-4	155	1500	124			60.00	
		1300	93	34	4.30	13.75	4
		1245	Unit start-up				
		0815	Unit shut-down				
		0715	Acid flushed the membrane stack				
		0705	107			14.50	
6-3	154	1520	58	72	7.85	22.00	
		1000	65				
		0935	Unit start-up				
		0715	Unit shut-down				
		0700	69			25.75	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
6-2	153	1517	92			34.25	
		0750				12.50	2
		0747	103			12.50	
6-1	152	1520	62	71	3.25		
		1511	62			21.00	
		1120	Unit start-up				
		0900	Unit shut-down				
		0800	Acid flushed the membrane stack				
		0724	69			23.00	
5-28	148	1450	200			66.00	
		1300	63	137	17.40	7.00	6
		0800	Acid flushed the membrane stack				
		0745	68			7.00	
5-27	147	1500	91			15.00	
		0745	102			18.50	
5-26	146	1500	59	70	8.60		
		1430	60			16.50	
		0823	69			29.00	
5-25	145	1435	98			36.00	
		1400				12.00	2
		1330	Unit start-up				
		1240	Hydraulic start-up				
		1000	Unit shut-down				
		0945	Acid flushed the membrane stack				
		0820	106			15.25	
5-24	144	1500	62	70	7.70		
		1447	62			23.25	
		1100	67			25.00	
5-21	141	1315	176				
		1245	64	112	15.50	10.50	4
		1130	Hydraulic start-up				
		0830	Unit shut-down				
		0712	Acid flushed the membrane stack				
		0705	75			11.00	
5-20	140	1615	101				
		1230	109			19.75	
		0945	46	71	9.25		
		0915	Unit shut-down				
		0705	49			21.50	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
5-19	139	0750				9.50	2
		0740	88			9.50	
5-18	138	2200	99			14.00	
		1530	110			14.00	
		1500	Unit start-up with one influent filter				
		1315	Acid flushed the membrane stack				
		0800	Biz flushed the membrane stack				
		0755	43	73	6.75		
		0720	44			17.75	
5-17	137	1430	69			25.50	
		0745	30			32.00	
5-14	134	1444	182			58.50	
		1240	45	139	16.25	24.50	3
		0900	Acid flushed the membrane stack				
		0730	Unit shut-down				
		0720	47			24.50	
5-13	133	1615	70			3.00	2
		0730	84			11.00	
5-12	132	1440	40	70	10.20	18.50	
		0730	52			22.00	
5-11	131	1515	77			30.00	
		1330	Unit start-up				
		0910	Unit shut-down				
		0745	Acid flushed the membrane stack				
		0710	89			10.00	2
5-10	130	1541	38	77	9.60	17.00	
		0805	52			20.50	
5-7	127	1430	88	70	8.60	26.00	4
		0700	98			30.00	
5-6	126	1330	132			38.50	
5-5	125	0745	173			52.00	
5-4	124	1440	155	140	17.50	60.50	
		0730	63			16.50	
5-3	123	1515	78			23.75	
4-30	120	1540	159			58.00	
		1320	Unit start-up				
		1024	Acid flushed the membrane stack				
		0900	49	139	17.40	18.50	4

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
4-29	119	1500	70			26.00	
		0920	79			6.00	2
4-28	118	1415	35	70	9.50		
		0750	45			11.50	
4-27	117	0808	80				
4-26	116	1530	99				
		0900	Unit start-up				
4-23	113	1400	Unit shut-down				
		1300	Acid flushed the membrane stack				
		0845	Biz flushed the membrane stack				
		0745	124			28.25	
4-22	112	1545	146			36.50	
		0910	50	105	7.40	16.25	2
		0835	Unit shut-down				
		0830	50			16.25	
4-21	111	1410	72				
		1320	75				
		1100	Unit shut-down				
		0945	Acid flushed the membrane stack				
		0815	Unit start-up				
		0745	Unit shut-down				
		0744	78			26.00	
4-20	110	1330	100			35.00	
		0915	Unit start-up				
		0815	Unit shut-down				
		0800	47	67	8.00	13.5	2
4-19	109	1140	73			22.50	
		1040	Unit start-up				
		0706	Unit shut-down				
4-18	108	0705	18	71	9.50	23.50	2
4-17	107	1600	82			16.50	
		1200	88			19.50	
		1130	Unit start-up				
		1037	Unit shut-down				
		1030	25	70	7.75	14.45	
4-16	106	0715	30			11.50	2

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
4-15	105	1145	114			20.50	
		1030	43	71	6.50		
		0930	Unit shut-down				
		0745	51			21.50	
4-14	104	1130	82				
		0838	Unit start-up				
		0801	Unit shut-down				
		0800	90				
		0745	21	69	7.40	10.00	2
4-13	103	1500	Unit start-up				
		0800	Unit shut-down				
		0730	67			21.00	
4-12	102	0900	102			11.50	2
		0820	Unit start-up				
		0745	Unit shut-down				
		0730	33	71	9.35	12.00	
4-9	99	1500	64	70	8.85	43.00	
		1215	Unit start-up				
		0815	Unit shut-down				
		0701	Acid flushed the membrane stack				
		0700	24	74	11.25	0.00	4
4-8	98	1500	47			13.50	
		0815	58			16.50	
4-7	97	1415	86			26.00	
		0950	24	69	8.00	4.00	2
4-6	96	1140	68			14.50	
		1115	Unit start-up				
		0930	Unit shut-down				
		0900	72			16.00	
4-5	95	1520	32	71	8.75		
		1315	36			25.25	
		0800	46			27.75	
4-4	94	1200		32	2.2		2
4-3	93	1435	77			23.25	
		1425	Unit start-up				
		1330	Hydraulic operation only				
		1200	Unit shut-down				
		1100	Biz flushed the membrane stack				
		1030	85			23.50	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
4-2	92	1600	114			33.50	
		1400	Unit start-up				
		1040	45	69	5.00	9.50	2
		1030	Acid flushed the membrane stack				
		0920	49			10.50	
4-1	91	1510	77			19.00	
3-31	90	0950	48			9.50	2
		0700	Unit start-up				
3-30	89	2100	Unit shut-down				
		0820	85			21.50	
3-29	88	2300	Unit start-up				
		1700	Unit shut-down				
		1500	42	70	9.75		
		1350	44			30.50	
		1115	Unit start-up				
		1025	Unit shut-down				
		1024	49			32.00	
		0830	52			33.00	
3-28	87		50		5.00		
3-27	86	1330	77			54.00	
		1329	Unit start-up				
3-26	85	1700	Unit shut-down				
		1500	23	149	10.35	56.50	
		1315	Unit start-up				
		1200	Unit shut-down				
		1130	36			34.50	2
		1055	Unit start-up				
		1010	Hydraulic start-up				
		0736	Acid flushed the membrane stack				
		0735	39			11.00	2
3-25	84	1430	67			18.75	
		1415	68			18.75	
		1340	Unit start-up				
		1140	Unit shut-down				
		1139	71			20.50	
		0740	78			22.75	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
3-24	83	1515	26	80	7.5		
		1500				32.00	2
		1430	Unit start-up				
		1400	Unit shut-down				
		0815	38			10.00	
3-23	82	1330	69			18.50	
		1240	Unit start-up				
		0926	Acid flushed the membrane stack				
		0925	86				
		0815	28	70	5.20	20.00	
3-22	81	0830	67				
3-21	80			55	8.80		2
3-20	79	1230	Unit start-up				
		1210	Unit shut-down				
		0910	93			31.50	
3-19	78	1500	45	81	11.00	40.50	
		1430	45			16.50	2
		0820	55			19.50	
		0700	Unit start-up				
3-18	77	2000	Unit shut-down				
		1100	87			31.00	
		1050	Unit start-up				
		0918	Unit shut-down				
		0800				10.00	2
		0720	21	71	7.00		
3-17	76	1445	46				
		0720	58			12.00	1
3-16	75	0810	26	70	8.55		
		0735	27			5.50	
3-15	74	1420	58			14.50	
		1100	Unit start-up				
		0900	Unit shut-down				
		0720	69			4.00	1
3-12	71	1500	26	149	14.25	38.00	
		1400	26			14.00	2
		0825	Unit start-up				
		0824					
		0800	46			17.50	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
3-11	70	1515	67			26.00	
		1500	Hydraulic start-up				
3-9	68	1100	Unit shut-down				
3-8	67	1420	90			5.00	2
		0830	Unit start-up				
		0800	Hydraulic start-up				
3-5	64	1445	Unit shut-down				
		1430	106			12.00	
		1330	Unit start-up				
		0930	Unit shut-down				
		0830	Acid flushed the membrane stack				
		0730	140			12.00	
3-4	63	1530	52	112	8.00	19.00	
		1500	Unit start-up				
		1430	Unit shut-down				
3-3	62	1430	52	71	10.40		
		1420	52			30.00	
		0930				8.00	2
		0910	34			8.00	
3-2	61	1420	93			17.00	
		1338	24	69	7.40	17.00	
		1330	Unit start-up				
		1220	Unit shut-down				
3-1	60	1240	74				
		1045	Unit start-up				
		0930	Unit shut-down				
2-26	57	1520	190			41.50	
		1420	46	146	17.10	20.00	2
		1419	Unit start-up				
		0930	Unit shut-down				
		0821	Acid flushed the membrane stack				
		0820	76				
		0815	78				
2-25	56	1355	38	72	5.90	6.5	1
2-24	55	1830	92			5.00	1
		1730	Unit start-up				
		1530	Hydraulic start-up				

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
2-23	54	0851	Unit shut-down				
		0850	95			6.00	
2-22	53	1445	58	73	8.00	10.00	
		1300	62			10.50	
		1100	Unit start-up				
		0815	66			11.50	
2-19	50	1515	Unit shut-down				
		1500	67			11.00	
		1020	76			12.50	
		1007	Unit start-up				
		0907	Unit shut-down				
		0806	Acid flushed the membrane stack				
		0805	83				
		0800	83			12.50	
2-18	49	1450	118				
		1445	48	70	7.10		
		0800	72			38.00	
2-17	48	1500	106				
		1430	Unit start-up				
2-16	47	1530	Unit shut-down				
		1430	41	68	6.80		1
		1400	Unit start-up				
2-11	42	0930	Unit shut-down				
		0815	Acid flushed the membrane stack				
		0814	105				
		0800	106				
2-10	41	1720	134			11.50	
		1600	Unit start-up				
		0825	137				1
2-9	40	1814					
		1530	Hydraulic operation only				
		1515	69	69	7.85		
		1420	Unit start-up				
		1200	Unit shut-down				
		0830	80			5.00	
2-8	39	1140	115			17.75	
		1135	45	70	8.60		
		1100	Unit start-up				
		1000	Unit shut-down				
		0825	49			11.00	1

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
2-6	37	1700	133			30.00	
		1645	Unit shut-down				
		1545	Unit start-up				
2-5	36	1500	47	140	15.00	16.00	2
		1415	47			16.00	
		0810	59			19.75	
2-4	35	1600	38	52	5.50	28.00	
		1520	39			28.00	
		1415	Unit start-up				
		0930	Unit shut-down				
		0800	43			29.00	
2-3	34	1900	71				
		1750	73				
		1700	Unit start-up				
		0800	Unit shut-down				
2-2	33	1007	87			27.75	
		1006	Hydraulic start-up				
2-1	32	1500	93				
1-30	30	1200	Unit shut-down				
1-29	29	1500	73	107	6.75	13.75	3
		1430	74			13.75	
		0802	88				
1-28	28	1745	117			24.00	
		1730				12.00	1
		1445	57	70	6.90		
		0836	64				
1-27	27	1550	94			24.00	
		1530	82			0.00	2
		1529	Unit start-up				
1-15	15	1230	Unit shut-down				
		0923	Acid flushed the membrane stack				
		0922	87				
		0830	88			19.75	
1-14	14	1530	139				
		1430	Unit start-up				
		0830	Biz flushed the membrane stack				
		0815	73	69	7.70	28.75	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1971	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
1-13	13	1410	70	58	8.30	12.50	2
		1000					
		0955	Unit start-up				
		0900	Unit shut-down				
		0859	76			16.00	
1-12	12	1600	60	70	8.70	23.50	
		1430	60			24.00	
		1415	60				2
		1410	Unit start-up				
		0800	Inspected the membrane stack				
1-7	7	1400	Unit shut-down				
		0800	117			15.00	
		0730	117				
1-6	6	1100	Hydraulic operation only				
<u>1970</u>							
12-18	352	1530	Unit shut-down				
		1500	81	113			
		1300	81				
		0720	26	70			
12-17	351	1500	89			10.00	
		1330	94				
		1030	103			11.75	
		1000	34	69		12.00	
		0955	Unit start-up				
12-16	350	1000	Hand cleaned the membrane stack				
		0730	29			4.00	
12-15	349	1515	81				
		1400	84			12.00	1
		1345	Unit start-up				
12-14	348	1215	Unit shut-down				
		1030	44			9.50	
		0930	Unit start-up				
12-10	344	1200	Unit shut-down				
		1145	34	103		6.00	1
		1130	Unit start-up				
		0600	Unit shut-down				

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1970	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
12-9	343	1500	Unit start-up				
		1305	Unit shut-down				
		1300	67			8.50	
		1000	76			10.50	
		0930	Unit start-up				
11-12	316		Hand cleaned the membrane stack				
11-5	309	0900	Unit shut-down				
11-4	308	1500	42	70	7.0	24.25	
		1000	55			26.50	
11-2	306	1530					
		0730					
10-30	303	1530					
10-29	302	1000					
10-28	301	1530					
		1430	Unit start-up				
		0900	Unit shut-down				
		0700	Unit start-up				
10-27	300	2300	Unit shut-down				
		1500					
		0730					
10-26		1600					
		1000					
		0955	Unit start-up				
10-21	294	1100	Biz flushed the membrane stack				
		1000	Acid flushed the membrane stack				
10-20	293	1400	Unit shut-down				
		0830					
10-19	292	0930					
10-18	291	1500	20	70		45.00	
10-16	289	1000	40	60		28.00	2
10-15	288	1000					
10-14	287	1500	105	60		46.50	
		1000					
10-13	286	1130					
		0830					
		0800	Unit start-up				
10-12	285	1400	Unit shut-down				
		0900					
		0830	Unit start-up				

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1970	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
10-1	274	1400 0835	Unit shut-down				
9-30	273	1530 1430 0830 0800	Unit start-up Unit shut-down 33				
9-29	272		Unit start-up				
8-28	240	0900 0800	Unit shut-down				
8-27	239	1500 1200 0800					
8-26	238	1400 1300 0700	Unit start-up Hydraulic start-up				
8-25	237	1500 1300 0700	Unit shut-down Hydraulic start-up Unit shut-down				
8-24	236	1530 1230 0945 0900 0845	67				
8-21	233	1500 0915 0845 0800	Unit start-up Hydraulic start-up Unit shut-down 72				
8-20	232	1500 1430 1300 1200 0900 0800	Unit start-up Unit shut-down 58				
8-19	231	1530 1500 1200 0900	Unit start-up Unit shut-down, tightened down stack 89				
			28		7.0		15.00

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1970	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
8-18	230	2400	Unit start-up				
		2200	Unit shut-down				
		1500					
		1445	Unit start-up				
		1430	Unit shut-down				
		1200					
		0900	89				
		0800					
8-17	229	1500					
		1300				30.00	
		1000	140				
		0900					
8-14	226	1500				15.00	
		0830	102				
		0800					
8-13	225	1530					
		1400	Unit start-up				
		1000	Unit shut-down				
		0835	78				
		0800					
8-12	224	1500					
		1200					
		0800					
8-11	223	1500					
		1300					
		1200	Unit start-up				
		1000	Unit shut-down				
		0800					
8-10	222	1500					
		1300					
		0930	87				
		0800				10.00	
8-9	221	1500	110				
8-7	219	1200				8.00	
		1015	69				
		0800					

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1970	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
8-6	218	1500					
		1300					
		1255	Unit start-up				
		1245	Unit shut-down				
		0830	60			15.00	
		0800					
8-5	217	1615	100			15.00	
		1200					
		1155	Unit start-up				
		1100	Unit shut-down				
		0900				15.00	
		0830					
8-4	216	1510				15.00	
		1501	55				
		1500	Unit start-up				
		0830	Hand cleaned the membrane stack				
		0800					
8-3	215	1500					
		1200					
		0800				6.00	
8-2	214	1300	76			30.00	
7-31	212	1300	170				
		0800					
7-30	211	1500					
		1100	Unit start-up				
7-29	210	2300	Unit shut-down				
		1200					
		1000					20.0
		0830	107				
		0730	Unit start-up				
7-28	209	0700	Hand cleaned the membrane stack				
		1530	Unit start-up				
7-27	208	1300	Unit shut-down				
		0900	35				
		0800					
7-24	205	0800	120			10.0	
7-23	204	0806	128			8.0	
7-22	203	0840	160				

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1970	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
7-21	202	0900					
		0840	184			10.00	
7-20	201	0800	109			15.00	
		0730	110				
7-17	198	0900	188			20.00	
		0830	188			20.00	
7-16	197	0900	57			30.00	
7-15	196	0900	87			10.00	
7-14	195	1500	Unit start-up				
		0800	Hand cleaned the membrane stack				
		0755	108			20.00	
7-13	194	0830	135			20.00	
7-10	191	0800		96		20.00	
7-9	190	1530		117		20.00	
		1525	Unit start-up				
		1500	Unit shut-down				
		0800	Unit start-up				
		0700	Unit shut-down				
7-8	189	1530				10.00	
		1500	Unit start-up				
		0900	Hand cleaned the membrane stack				
7-6	187	0920	28			30.00	
7-3	184	0800	63	70	5.00	15.00	
		0700	Unit start-up				
7-1	182	1530	Unit shut-down				
		1100					
6-30	181	0840	54			15.00	
6-29	180	0900	35			30.00	
6-26	177	0830	48				
6-25	176	0800	70			8.00	
6-24	175	1500	87			18.00	
		1455	Unit start-up				
		0700	Hand cleaned the membrane stack				
6-23	174	1230	Unit start-up				
		1100	Unit shut-down				
		0800	110				
6-22	173	0930	128			18.00	
6-21	172	1300	150			36.00	
6-20	171	1000	175			30.00	
6-18	169	1030	63			18.00	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1970	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
6-17	168	0900	92			36.00	
		0800	Unit start-up				
6-16	167	1330	Hydraulic operation only				
		0830	114			12.00	
6-15	166	0900	134			24.00	
6-14	165	1120	152			30.00	2
6-13	164	1100	170			18.00	
6-12	163	1030	192			18.00	
6-11	162	1530	Unit start-up				
		0800	Hand cleaned the membrane stack				
6-9	160	0900	147			18.00	
		0800	Unit start-up				
6-8	159	0800	Hydraulic operation only				
6-5	156	0840	57			18.00	
6-4	155	0800	80			18.00	
6-3	154	0900	96			36.00	
6-2	153	0900	112			18.00	
6-1	152	0730	127			36.00	
		0700	Unit start-up				
5-30	150	2400	Unit shut-down				
		1030	150			36.00	
5-28	148	1500	192			36.00	
		1455	Unit start-up				
		0720	Unit shut-down				
5-25	145	0800	Unit start-up				
5-22	142	0730	Hand cleaned the membrane stack				
		0720	45			18.00	
5-21	141	1100	82			36.00	
5-20	140	1200	110			18.00	
5-19	139	0900				4.00	
		0855	Tightened the membrane stack				
5-18	138	0705	81			18.00	
		0700	Tightened the membrane stack				
5-17	137	1120	86			24.00	
5-16	136	1130	126			36.00	2
5-15	135	0800	95			18.00	
5-14	134	0900	132			7.00	
5-13	133	0900	164			36.00	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1970	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
4-15	105	1500	134			18.00	
		1230	138			18.00	
		0900	145			18.00	
		0700	Unit start-up				
4-14	104		Unit shut-down				
4-13	103	1400	Unit start-up				
		1335	Unit shut-down				
		1330	160			36.00	
		0700	Unit start-up				
3-20	79	1130	Unit shut-down				
		1030	163			23.00	
		1000	Unit start-up				
		0700	Unit shut-down				
3-19	78	1500	197			12.00	
		1200	63			13.50	
		0800	68			14.00	
3-18	77	1500	98			2.00	
		1200	105			12.00	
		0800	113			14.00	
3-17	76	1500	139			21.00	
		1200	146			22.00	
		0800	153			14.00	1
3-16	75	1500	183			23.00	
		1200	189			24.00	
		1130	Unit start-up				
		0815	Unit shut-down				
		0800	53	140		0.00	2
3-14	73	0830	144			1.00	1
3-13	72	1500	175			24.00	
		1200	179			24.00	
		0800	130	56	4.00	12.00	1
3-12	71	1500	158			24.00	
		1200	52	112	8.00	24.00	

TABLE B-5 ACID AND "CALGON" LEVELS AND ADDITIONS (CONTINUED)

1970	Day	Time	Dilute Acid Level In Gallons	Dilute Acid Injected In Gallons	Conc H ₂ SO ₄ Level In Inches	Calgon Tank Level In Inches	Lbs Dry Calgon Added
5-12	132	1500	165			24.00	
5-11	131	0800	175			36.00	
5-10	130	1000	178			12.00	
5-9	129	0940				18.00	
5-8	128	1330				36.00	
		1000	45				
5-7	127	0930	93			12.00	
		0925	Unit start-up				
		0900	Unit shut-down				
5-6	126	1530	Unit start-up				
		1000	Hand cleaned the membrane stack				
		0930	124			12.00	
5-5	125	0815	30			6.00	
5-4	124	1400	62			9.00	
		1000	70			9.00	
		0955	Unit start-up				
4-27	117	1300	Unit shut-down				
		0700	66	140		36.00	2
4-24	114	0800	82	112	8.00	27.00	
4-23	113	0700	123			18.00	
4-22	112	1330	156			18.00	
		0900	163			18.00	
4-21	111	1330	60	140	7.00	36.00	1
		0900	67			18.00	
4-20	110	1410	92			27.00	
		1330	Unit start-up				
		1300	Unit shut-down				
		0900	98			30.00	
		0830	Unit start-up				
		0700	Unit shut-down				
4-17	107	1500	57			18.00	
		1330	60			18.00	
		0900	67			18.00	
4-16	106	1500	95			36.00	
		1230	98				
		0900	105			18.00	

TABLE B-6 HOUR METER AND POWER READINGS

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
7-2	183	1340	7003.2	7000.2	6579.2	6642.7	61247
		1320	Unit start-up				
		0930	Acid flushed the membrane stack				
		0737	6996.2	6996.2	6575.2	6638.7	61226
7-1	182	1500	6982.6	6979.6	6558.6	6622.1	61117
		0720	6974.9	6971.9	6550.9	6614.4	61064
6-30	181	1312	Started sand filter influent				
		1312	6953.7	6953.7	6532.7	6576.2	60939
		1140					
		0735	6951.2	6948.2	6527.2	6590.7	60998
6-29	180	1430	6934.3	6931.3	6510.3	6573.8	60776
		1415	Unit start-up				
		1330	Unit shut-down				
		0715	6927.6	6924.6	6503.6	6567.1	60732
6-28	179	1445					
		1430	6910.0	6908.0	6487.0	6550.5	60612
		0930	6906.1	6903.1	6482.2	6545.7	60576
		0715	Unit start-up				
		0735	Hydraulic start-up				
6-25	176	1530	Unit shut-down				
		0710	Hand cleaned the membrane stack				
		0707	6903.6	6900.6	6480.1	6543.6	60565
6-24	175	1520	6887.9	6884.9	6464.5	6528.0	60465
		1515					
		1500	Unit start-up				
		1435	Unit shut-down				
		1400	Acid flushed the membrane stack				
		1000	6883.0	6880.0	6462.8	6526.4	60448
		0732	6882.2	6879.2	6462.0	6525.6	60443
6-23	174	1530	6865.9	6863.0	6445.8	6509.4	60342
		1445	Unit start-up				
		0930	Unit shut-down				
		0730	EDTA flushed the membrane stack				
		0705	6862.1	6859.2	6444.4	6508.0	60327

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			F Pump	Recirculation Pump	Acid Pump	Chemical Pump	
6-22	173	1515	6846.3	6843.3	6428.6	6492.1	60227
		1445	Unit start-up				
		1415					
		1400	Unit shut-down				
		1300	Acid flushed the membrane stack				
6-21	172	0710	6838.9	6835.9	6421.2	6484.8	60185
		1500	6827.7	6819.8	6405.0	6468.6	60082
		1445	Unit start-up				
		1200	Unit shut-down				
		0930	Unit start-up				
6-18	169	0830	Unit shut-down				
		0730	Acid flushed the membrane stack				
		0715	6815.5	6812.6	6397.8	6461.4	60045
		1500	6751.3	6746.3	6333.6	6397.2	59662
		1445					
6-17	168	0835	6744.9	6742.0	6327.2	6390.8	39622
		0750	Unit start-up				
		1700	Unit shut-down				
		1250	6739.9	6736.0	6321.9	6385.0	59585
		1145					
6-16	167	0720	6733.4	6730.5	6316.3	6379.4	59551
		1500	6717.0	6714.0	6299.9	6363.0	59442
		1330					
		1240	Unit start-up				
		0905	Unit shut-down				
6-15	166	0805	Acid flushed the membrane stack				
		0710	6710.8	6707.8	6293.7	6356.8	59412
		1500	6694.7	6691.7	6277.7	6340.7	59315
		1450					
		1400	Unit start-up				
		1100	Unit shut-down				
		1000	Biz flushed the membrane stack				
		0710	6689.8	6686.8	6274.3	6337.4	59392

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
6-14	165	1510	6672.5	6669.5	6257.8	6320.1	59278
		1330	6670.8	6667.8	6255.3	6318.4	59167
		1325	Unit start-up				
		1200	Unit shut-down				
		0930	Unit start-up				
		0815	Unit shut-down				
		0720					
		0715	Acid flushed the membrane stack				
		0700	Unit start-up				
6-13	164	1800	Unit shut-down				
6-11	162	0736	Unit start-up				
		0720					
		0713	Unit shut-down				
6-10	161	0702	6607.9	6605.0	6197.5	6255.6	58762
		1430	6591.2	6588.2	6175.8	6238.9	58652
		0805	6584.9	6582.0	6189.5	6232.6	58609
6-9	160	1500	6568.1	6565.1	6152.7	6215.7	58496
		0710					
		0706	6559.9	6557.9	6144.5	6207.6	58441
6-8	159	1520					
		1515	6544.1	6541.2	6128.7	6191.8	58332
		1022	Unit start-up				
		0922	Unit shut-down				
		0750	Acid flushed the membrane stack				
6-7	158	0743	6538.5	6535.5	6123.1	6186.2	58300
		1530	6522.3	6519.3	6106.9	6170.0	58192
		0820					
6-4	155	0708	6513.9	6510.9	6098.5	6161.6	58137
		1500	6449.8	6446.9	6034.5	6097.5	57702
		1300					
		1245	Unit start-up				
6-3	154	0815	Unit shut-down				
		0715	Acid flushed the membrane stack				
		0705	6444.0	6441.1	6028.7	6091.8	57672
		1520	6428.3	6425.4	6013.0	6076.1	57573
		1000	6423.0	6420.0	6007.7	6070.7	57541
		0935	Unit start-up				
		0715	Unit shut-down				
		0700	6420.0	6417.1	6004.7	6067.8	57527

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
6-2	153	1517	6404.2	6401.3	6988.9	6051.9	57428
		0750					
		0747	6396.8	6393.8	5981.5	6044.5	57379
6-1	152	1520					
		1511	6378.0	6375.0	6562.7	6025.7	57256
		1120	Unit start-up				
		0900	Unit shut-down				
		0800	Acid flushed the membrane stack				
		0724	6373.7	6370.6	5958.5	6021.6	57235
5-28	148	1450	6284.7	6281.7	5869.4	5932.5	56665
		1300					
		0800	Acid flushed the membrane stack				
		0745	6280.5	6277.5	5865.2	5928.3	56648
5-27	147	1500	6263.8	6260.9	5848.6	5911.7	56542
		0745	6256.5	6253.6	5841.3	5904.4	56495
5-26	146	1500					
		1430	6239.1	6236.2	5823.9	5887.0	56379
		0823	6233.1	6230.2	5817.9	5881.0	56339
5-25	145	1435	6215.3	6212.4	5800.1	5863.2	56217
		1400					
		1330	Unit start-up				
		1240	Hydraulic start-up				
		1000	Unit shut-down				
		0945	Acid flushed the membrane stack				
		0820	6211.7	6208.8	5796.5	5859.6	56198
5-24	144	1500					
		1447	6194.1	6191.2	5778.9	5842.0	56081
		1100	6190.5	6187.6	5775.3	5838.4	56058
5-21	141	1315	6120.7	6117.4	5705.4	5768.5	55589
		1245	Unit start-up				
		1130	Hydraulic start-up				
		0830	Unit shut-down				
		0712	Acid flushed the membrane stack				
		0705	6117.4	6114.5	5702.3	5765.4	55574
5-20	140	1615	6102.6	6099.6	5687.4	5750.6	55473
		1230	6099.7	6096.2	5684.1	5747.2	55452
		0945	Unit start-up				
		0915	Unit shut-down				
		0705	6094.6	6091.6	5679.6	5742.7	55423

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
5-19	139	0750					
		0740	6070.4	6067.4	5655.4	5718.5	55263
5-18	138	2200	6061.0	6058.1	5646.0	5709.1	55119
		1530	6054.1	6051.1	5639.1	5702.2	55149
		1500	Unit start-up with one influent filter				
		1315	Acid flushed the membrane stack				
		0800	Biz flushed the membrane stack				
		0755					
		0720	6049.4	6046.4	5636.3	5701.2	55132
5-17	137	1430	6032.5	6029.6	5619.4	5684.3	55021
		0745	6025.7	6022.6	5612.6	5677.5	54075
5-14	134	1444	5961.4	5958.5	5548.3	5613.2	54549
		1240	Unit start-up				
		0900	Acid flushed the membrane stack				
		0730	Unit shut-down				
		0720	5957.0	5954.1	5543.9	5609.5	54526
5-13	133	1615	5941.9	5939.0	5528.8	5594.3	54428
		0730	5933.1	5930.1	5520.0	5585.5	54371
5-12	132	1440	5916.4	5913.4	5503.3	5568.8	54158
		0730	5909.3	5906.3	5496.2	5561.7	54209
5-11	131	1515	5892.9	5890.0	5479.9	5545.4	54098
		1330	Unit start-up				
		0910	Unit shut-down				
		0745	Acid flushed the membrane stack				
		0710	5888.8	5885.8	5475.7	5541.2	54075
5-10	130	1541	5873.3	5870.3	5460.2	5525.7	53977
		0805	5865.7	5862.8	5452.7	5518.2	53928
5-7	127	1430	5800.1	5797.1	5387.0	5452.6	53503
		0700	5792.7	5789.7	5379.6	5445.1	53452
5-6	126	1330	5775.5	5772.6	5362.5	5428.1	
5-5	125	0745	5745.9	5743.0	5331.9	5398.5	
5-4	124	1440	5729.7	5726.7	5316.7	5382.2	53031
		0730	5721.7	5718.8	5308.8	5374.3	52978
5-3	125	1515	5705.4	5702.5	5292.5	5358.0	52865
4-30	120	1540	5633.9	5631.0	5221.0	5286.5	52371
		1320	Unit start-up				
		1024	Acid flushed the membrane stack				
		0900	5628.5	5625.5	5215.5	5281.0	52340

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
4-29	119	1500	5611.2	5608.2	5198.2	5263.7	52224
		0920	5604.18	5601.9	5191.9	5257.4	52180
4-28	118	1415					
		0750	5579.4	5576.4	5166.4	5231.9	51008
4-27	117	0808	5555.7	5552.7	5142.7	5208.2	51846
4-26	116	1530					
		0900	Unit start-up				
4-23	113	1400	Unit shut-down				
		1300	Acid flushed the membrane stack				
		0845	Biz flushed the membrane stack				
		0745	5541.0	5538.1	5129.9	5196.1	51756
4-22	112	1545	5525.0	5522.1	5113.8	5180.0	51651
		0910	Unit start-up				
		0835	Unit shut-down				
		0830	5518.0	5515.1	5106.8	5173.0	51602
4-21	111	1410	Unit start-up				
		1320	Hydraulic start-up				
		1100	Unit shut-down				
		0945	Acid flushed the membrane stack				
		0815	Unit start-up				
		0745	Unit shut-down				
		0744	5495.5	5492.6	5084.6	5151.2	51458
4-20	110	1330	5477.3	5474.4	5066.4	5133.1	51338
		0915	Unit start-up				
		0815	Unit shut-down				
		0800					
4-19	109	1140	5451.9	5449.0	5041.1	5107.7	51169
		1040	Unit start-up				
		0706	Unit shut-down				
4-18	108	0705	5450.4	5447.5	5039.7	5106.2	51160
5-17	107	1600	5411.2	5408.3	5000.5	5067.1	50907
		1200	5407.2	5404.2	4996.5	5063.1	50879
		1130	Unit start-up				
		1037	Unit shut-down				
		1030	5406.5	5403.6	4995.8	5062.4	50875
4-16	106	0715	5379.4	5376.5	4968.7	5035.3	50698

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
4-15	105	1145	5359.9	5357.0	4949.9	5015.8	50568
		1030	Unit start-up				
		0930	Unit shut-down				
		0745	5357.3	5354.4	4947.2	5013.5	40557
4-14	104	1130	5333.8	5330.9	4923.7	4990.9	50402
		0838	Unit start-up				
		0801	Unit shut-down				
		0800	533.3	5330.4	4923.1	4989.5	50400
		0745	5332.9	5330.0	4922.8	4989.1	50398
4-13	103	1500	Unit start-up				
		0800	Unit shut-down				
		0730	5308.6	5305.7	4899.2	4964.9	50248
4-12	102	0900	5286.3	5283.4	4876.9	4942.5	50098
		0820	Unit start-up				
		0745	Unit shut-down				
		0730	5284.8	5281.9	4875.4	4941.1	50088
4-9	99	1500	5220.3	5217.4	4810.9	4876.6	49646
		1215	Unit start-up				
		0815	Unit shut-down				
		0701	Acid flushed the membrane stack				
		0700	5217.1	5214.2	4807.7	4873.5	49631
4-8	98	1500	5201.1	5196.2	4791.7	4857.5	49524
		0815	5194.3	5191.4	4784.8	4850.7	49478
4-7	97	1415	5176.3	5173.4	4766.9	4832.7	49357
		0950	5170.9	5168.0	4827.3	4761.5	49322
4-6	96	1140	5149.7	5146.7	4740.2	4806.1	49173
		1115	Unit start-up				
		0930	Unit shut-down				
		0900	5147.0	5144.1	4737.6	4803.5	49162
4-5	95	1520					
		1315	5127.3	5124.4	4717.9	4783.7	49026
		0800	5122.0	5119.1	4712.6	4778.4	49090
4-4	94	1200					
4-3	93	1435	5080.6	5077.7	4671.2	4737.1	48702
		1425	Unit start-up				
		1330	Hydraulic operation only				
		1200	Unit shut-down				
		1100	Biz flushed the membrane stack				
		1030	5075.6	5078.5	4670.5	4736.3	48693

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
4-2	92	1600	5059.9	5057.1	4651.9	4717.7	48568
		1400	Unit start-up				
		1040	5057.6	5054.3	4649.4	4715.3	48555
		1030	Acid flushed the membrane stack				
4-1	91	0920	5055.9	5053.0	4648.2	4714.1	48551
		1510	5037.9	5035.0	4630.1	4696.0	48431
		0950	5008.5	5005.7	4600.8	4666.7	48229
		0700	Unit start-up				
3-30	89	2100	Unit shut-down				
		0820	4982.9	4980.9	4575.2	4641.0	48088
3-29	88	2300	Unit start-up				
		1700	Unit shut-down				
		1500					
		1350	4964.4	4961.5	4556.7	4622.6	48083
		1115	Unit start-up				
		1025	Unit shut-down				
		1024	4961.1	4958.2	4553.4	4619.2	48064
		0830	4959.1	4956.2	4551.4	4617.2	48051
3-28	87						
3-27	86	1330	4916.7	4913.6	4508.9	4574.9	47671
		1329	Unit start-up				
3-26	85	1700	Unit shut-down				
		1500	4913.4	4910.5	4571.5	4505.7	47652
		1315	Unit start-up				
		1200	Unit shut-down				
		1130	4910.0	4907.1	4504.1	4568.2	47634
		1055	Unit start-up				
		1010	Hydraulic start-up				
		0736	Acid flushed the membrane stack				
3-25	84	0735	4907.4	4904.5	4501.5	4565.6	47623
		1430	4890.3	4887.5	4484.5	4548.5	47508
		1415	4890.0	4887.1	4484.2	4548.2	47506
		1340	Unit start-up				
		1140	Unit shut-down				
		1139	4887.4	4884.5	4481.6	4545.6	47497
		0740	4883.5	4880.6	4477.6	4541.7	47469

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
3-24	83	1515					
		1500					
		1430	Unit start-up				
		1400	Unit shut-down				
3-23	82	0815	4860.1	4857.2	4454.2	4518.2	47316
		1330	4841.2	4838.3	4435.3	4499.3	47183
		1240	Unit start-up				
		0926	Acid flushed the membrane stack				
		0925	4838.5	4835.6	4433.4	4496.8	47172
3-22	81	0815	4837.3	4834.5	4432.3	4495.7	47167
		0830	4816.0	4811.1	4408.9	4472.2	47016
3-21	80						
3-20	79	1230	Unit start-up				
		1210	Unit shut-down				
		0910	4766.4	4763.5	4361.3	4424.7	46705
3-19	78	1500					
		1430	4747.6	4744.7	4342.5	4405.9	46578
		0820	4741.8	4738.9	4336.7	4400.1	46538
		0700	Unit start-up				
3-18	77	2000	Unit shut-down				
		1100	4720.2	4717.3	4315.1	4378.4	46423
		1050	Unit start-up				
		0918	Unit shut-down				
		0800					
3-17	76	0720	4716.4	4713.6	4311.4	4374.7	46401
		1445	4699.9	4697.0	4294.8	4358.2	46292
		0720	4692.5	4689.6	4287.4	4350.8	46243
3-16	75	0810					
		0735	4668.8	4665.9	4263.7	4327.1	46088
3-15	74	1420	4651.5	4648.6	4246.4	4309.7	46068
		1100	Unit start-up				
		0900	Unit shut-down				
		0720	4644.5	4641.6	4239.4	4302.8	46025
3-12	71	1500					
		1400	4579.6	4576.7	4174.5	4237.9	45483
		0825	Unit start-up				
		0824	4573.6	4570.7	4168.5	4231.9	45443
		0800	4573.1	4570.3	4168.1	4231.4	45441

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
3-11	70	1515	4556.4	4553.5	4151.3	4214.7	45376
		1500	Hydraulic start-up				
3-9	68	1100	Unit shut-down				
3-8	67	1420	4549.7	4546.9	4146.1	4209.4	45340
		0830	Unit start-up				
		0800	Hydraulic start-up				
3-5	64	1445	Unit shut-down				
		1430	4542.8	4540.0	4139.6	4203.0	45300
		1330	Unit start-up				
		0930	Unit shut-down				
		0830	Acid flushed the membrane stack				
		0730	4539.2	4536.4	4136.6	4200.0	45281
3-4	63	1530	4523.1	4520.3	4120.6	4183.9	45170
		1500	Unit start-up				
		1430	Unit shut-down				
3-3	62	1430					
		1420	4502.5	4499.7	4100.0	4163.3	45035
		0930					
		0910	4497.9	4495.1	4095.4	4158.8	45007
3-2	61	1420	4479.1	4476.3	4076.6	4139.9	44879
		1338					
		1330	Unit start-up				
		1220	Unit shut-down				
3-1	60	1240	4454.6	4451.9	4052.3	4115.7	44718
		1045	Unit start-up				
		0930	Unit shut-down				
2-26	57	1520	4385.4	4382.6	3983.1	4047.6	44252
		1420					
		1419	Unit start-up				
		0930	Unit shut-down				
		0821	Acid flushed the membrane stack				
		0820	4384.2	4381.4	3982.0	4046.5	44247
		0815	4383.0	4380.3	3980.8	4045.3	44243
2-25	56	1355	4364.7	4362.0	3962.5	4027.0	44118
2-24	55	1830	4345.2	4342.5	3943.0	4007.5	44082
		1730	Unit start-up				
		1530	Hydraulic start-up				

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
2-23	54	0851	Unit shut-down				
		0850	4333.2	4330.5	3940.6	4003.2	44041
2-22	53	1445					
		1300	4314.3	4311.5	3921.7	3984.3	43808
		1100	Unit start-up				
		0815	4309.6	4306.9	3919.4	3982.2	43784
2-19	50	1515	Unit shut-down				
		1500	4309.5	4306.8	3919.4	3982.2	43783
		1020	4304.8	4302.1	3914.7	3977.4	43752
		1007	Unit start-up				
		0907	Unit shut-down				
		0806	Acid flushed the membrane stack				
		0805	4300.2	4302.9	3913.0	3975.6	43744
		0800					
2-18	49	1450	4285.6	4283.1	3895.9	3958.5	43628
		1445					
		0800	4279.0	4276.2	3889.0	3951.7	43579
2-17	48	1500	4261.8	4259.2	3872.0	3934.6	43462
		1430	Unit start-up				
2-16	47	1530	Unit shut-down				
		1430	4259.2	4256.4	3871.2	3933.9	43449
		1400	Unit start-up				
2-11	42	0930	Unit shut-down				
		0815	Acid flushed the membrane stack				
		0814	4257.8	4255.1			
		0800	4257.6	4254.9	3870.1	3933.8	43445
2-10	41	1720	4243.0	4240.2	3855.5	3919.1	43347
		1600	Unit start-up				
		0825	4234.0	4231.3	3854.5	3918.5	43314
2-9	40	1814	4219.8	4217.1	3854.5	3918.5	43263
		1530	Hydraulic operation only				
		1515	4216.9	4214.1	3854.2	3915.7	43251
		1420	Unit start-up				
		1200	Unit shut-down				
		0830	4210.9	4208.1	3848.2	3909.7	43217
2-8	39	1140	4189.9	4187.2	3828.1	3888.7	43182
		1135					
		1100	Unit start-up				
		1000	Unit shut-down				
		0825	4186.7	4183.9	3826.1	3885.5	43168

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
2-6	37	1700	4147.2	4144.5	3846.1	3786.7	42815
		1645	Unit shut-down				
		1545	Unit start-up				
2-5	36	1500					
		1415	4120.5	4117.8	3761.1	3819.4	42632
		9810	4115.5	4111.7	3755.1	3813.3	42591
2-4	35	1600					
		1520	4097.6	4094.9	3738.2	3796.5	42475
		1415	Unit start-up				
		0930	Unit shut-down				
		0800	4095.5	4092.8	3736.2	3794.5	42465
2-3	34	1900	4081.8	4079.0	3722.5	3780.8	42369
		1750	4080.8	4078.0	3721.5	3779.8	42362
		1700	Unit start-up				
		0800	Unit shut-down				
2-2	33	1007	4076.6	4073.9	3718.3	3775.8	42347
		1006	Hydraulic start-up				
2-1	32	1500	4074.2	4071.5	3716.5	3775.6	42338
1-30	30	1200	Unit shut-down				
1-29	29	1500					
		1430	4049.0	4046.3	3694.1	3750.4	42292
		0802	4042.6	4039.9	3687.6	3743.9	37439
1-28	28	1745	4028.3	4025.6	3673.3	3729.7	42160
		1730					
		1445					
		0836	4019.1	4016.4	3664.2	3720.5	42099
1-27	27	1550	4004.4	4001.7	3649.5	3705.8	41999
		1530	4004.0	4001.3	3649.0	3705.0	41998
		1529	Unit start-up				
1-15	15	1230	Unit shut-down				
		0923	Acid flushed the membrane stack				
		0922	3966.3	3963.6	3637.8	3692.0	41766
		0830	3965.6	3963.9	3632.1	3691.3	41761
1-14	14	1530	3948.4	3945.8	3614.9	3674.2	41653
		1430	Unit start-up				
		0830	Biz flushed the membrane stack				
		0815	3943.7	3941.1	3613.3	3672.6	41634

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1971	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
1-13	13	1410	3925.7	3923.0	3595.3	3654.5	41518
		1000					
		0955	Unit start-up				
		0900	Unit shut-down				
		0859	3920.6	3917.9	3590.2	3649.4	41487
1-12	12	1600	3903.4	3900.7	3573.0	3632.2	41371
		1430		3899.9			41368
		1415	3902.1	3899.4	3571.7	3631.0	41365
		1410	Unit start-up				
		0800	Inspected the membrane stack				
1-7	7	1400	Unit shut-down				
		0800					
		0730	3875.7	3873.1	3545.8	3605.2	41264
1-6	6	1100	Hydraulic operation only				
<u>1970</u>							
12-18	352	1530	Unit shut-down				
		1500	3856.8	3854.1	3528.0	3586.9	41183
		1300	3855.0	3852.4	3526.2	3585.2	41172
		0720	3849.2	3846.6	3520.5	3579.4	41135
12-17	351	1500	3832.9	3830.3	3504.1	3563.1	41026
		1330	3831.6	3828.9	3502.8	3561.8	41018
		1030	3828.7	3826.0	3499.9	3558.8	40998
		1000					
		0955	Unit start-up				
12-16	350	1000	Hand cleaned the membrane stack				
		0730	3824.7	3822.2	3496.8	3556.3	40979
12-15	349	1515	3808.4	3805.8	3480.5	3540.0	40873
		1400	3807.1	3804.6	3479.3	3538.7	40867
		1345	Unit start-up				
12-14	348	1215	Unit shut-down				
		1030	3803.1	3800.6	3475.5	3535.0	40843
		0930	Unit start-up				
12-10	344	1200	Unit shut-down				
		1145	3790.0	3787.5	3462.8	3525.8	40788
		1130	Unit start-up				
		0600	Unit shut-down				

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1970	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
12-9	343	1500	Unit start-up				
		1305	Unit shut-down				
		1300	3769.1	3766.7	3443.2	3504.8	40668
		1000	3764.2	3761.8	3438.3	3500.0	40647
		0930	Unit start-up				
11-12	316		Hand cleaned the membrane stack				
11-5	309	0900	Unit shut-down				
11-4	308	1500	3732.8	3730.4	3415.0	3477.3	40502
		1000	3727.7	3725.3	3409.9	3472.2	40471
11-2	306	1530	3685.0	3682.5	3367.2	3429.4	40293
		0730	3679.0	3676.5	3361.6	3428.3	40266
10-30	303	1530	3614.7	3612.3	3297.3	3364.0	39743
10-29	302	1000	3586.6	3584.2	3269.3	3336.0	39552
10-28	301	1530	3568.0	3565.6	3250.7	3317.4	39423
		1430	Unit start-up				
		0900	Unit shut-down				
		0700	Unit start-up				
10-27	300	2300	Unit shut-down				
		1500	3544.7	3542.3	3227.5	3294.2	39218
10-26		1600	3529.2	3526.8	3212.7	3279.5	39168
		1000	3523.0	3520.6	3206.5	3273.3	39125
		0955	Unit start-up				
10-21	294	1100	Biz flushed the membrane stack				
		1000	Acid flushed the membrane stack				
10-20	293	1400	Unit shut-down				
		0830	3515.6	3513.2	3203.3	3270.1	39195
10-19	292	0930	3510.2	3507.8	3198.0	3264.8	39161
10-18	291	1500	3491.0	3489.0	3179.0	3246.0	38940
10-16	289	1000	3439.2	3436.8	3127.2	3194.2	38590
10-15	288	1000	3415.1	3412.7	3104.3	3171.3	38442
10-14	287	1500	3396.0	3393.0	3085.0	3152.0	38325
		1000	3391.3	3389.0	3080.6	3147.6	38286
10-13	286	1130	3368.8	3366.4	3058.0	3125.2	38234
		0830	3365.9	3363.6	3055.2	3122.3	38114
		0800	Unit start-up				
10-12	285	1400	Unit shut-down				
		0900					
		0830	Unit start-up				

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1970	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
10-1	274	1400	Unit shut-down				
		0835	3552.6	3350.3	3043.0	3110.6	38029
9-30	273	1530	Unit start-up				
		1430	Unit shut-down				
		0830	3329.0	3889.0	3331.0	3024.0	30910
		0800	3331.2	3328.9	3023.8	3091.4	37892
9-29	272		Unit start-up				
8-28	240	0900	Unit shut-down				
		0800	3260.8	3258.6	2973.7	3041.8	37532
8-27	239	1500	3243.7	3241.5	2956.6	3024.8	37415
		1200	3241.8	3239.6	2954.8	3022.9	37400
		0800	3236.9	3234.7	2949.8	3017.9	37368
8-26	238	1400	3219.2	3217.0	2932.1	3000.3	37250
		1300	Unit start-up				
		0700	Hydraulic start-up				
8-25	237	1500	Unit shut-down				
		1300	Hydraulic start-up				
		0700	Unit shut-down				
8-24	236	1530	3195.5	3193.3	2908.4	2978.2	37112
		1230	3192.7	3190.4	2905.6	2975.4	37092
		0945	3189.0	3187.0	2902.0	2972.0	37070
		0900	3189.6	3187.4	2902.6	2972.4	37069
		0845	Unit start-up				
8-21	233	1500	Hydraulic start-up				
		0915	Unit shut-down				
		0845	3119.0	3117.0	2897.0	2903.0	36800
		0800	3118.8	3116.6	2896.7	2902.7	36794
8-20	232	1500	3102.4	3100.2	2880.3	2886.3	36683
		1430	Unit start-up				
		1300	Unit shut-down				
		1200	3100.9	3098.7	2878.8	2884.9	36674
		0900	3098.0	3096.0	2876.0	2882.0	36650
		0800	3097.2	3095.0	2875.2	2881.2	36649
8-19	231	1530	Unit start-up				
		1500	Unit shut-down, tightened down stack				
		1200	3078.5	3076.3	2856.5	2862.6	36520
		0900	3075.6	3073.5	2853.7	2859.8	36499

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1970	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
8-18	230	2400	Unit start-up				36383
		2200	Unit shut-down				
		1500					
		1445	Unit start-up				
		1430	Unit shut-down				
		1200	3055.0	3052.8	2833.1	2839.2	36363
		0900	3052.0	3050.0	2830.0	2836.0	36340
		0800	3051.1	3049.0	2929.2	2835.3	36388
8-17	229	1500	3034.1	3032.0	2812.3	2813.3	36223
		1300	3031.8	3029.6	2809.9	2815.9	36205
		1000	3029.2	3027.1	2807.3	2813.4	36180
		0900	3028.2	3086.0	2806.3	2812.4	36279
8-14	226	1500	2962.4	2960.2	2740.5	2747.4	35768
		0830	2955.0	2953.0	2733.0	2740.0	35720
		0800	2955.1	2952.9	2733.2	2740.1	35717
8-13	225	1530	2938.7	2936.5	2716.9	2723.7	35607
		1400	Unit start-up				
		1000	Unit shut-down				
		0835	2932.0	2930.0	2711.0	2718.0	35570
		0800	2931.5	2929.3	2710.5	2717.9	33569
8-12	224	1500	2914.3	2912.1	2693.3	2700.7	35455
		1200	2911.2	2909.0	2690.2	2697.6	35434
		0800	2907.3	2905.1	2686.3	2693.8	35408
8-11	223	1500	2890.4	2888.2	2669.4	2676.8	35393
		1300	2888.3	2886.1	2667.3	2674.7	35382
		1200	Unit start-up				
		1000	Unit shut-down				
8-10	222	0800	2884.4	2882.3	2664.6	2671.1	35261
		1500	2867.7	2865.5	2647.9	2654.4	35148
		1300	2866.1	2864.0	2646.3	2652.8	35238
		0930	2862.0	2860.0	2642.0	2649.0	35100
		0800	2860.9	2958.7	2641.1	2647.6	
8-9	221	1500	2843.0	2841.0	2624.0	2630.0	34990
8-7	219	1200	2792.9	2790.7	2575.9	2581.5	34644
		1015	2791.1	2788.9	2573.1	2579.6	34630
		0800	2789.0	2786.8	2571.0	2577.5	34616

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1970	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
8-6	218	1500	2769.8	2771.9	2554.0	2560.5	24502
		1300	2770.1	2767.9	2552.2	2558.7	34488
		1255	Unit start-up				
		1245	Unit shut-down				
		0830	2765.0	2763.5	2547.0	2554.0	34450
		0800	2765.0	2762.9	2547.1	2553.6	34454
		1615	2748.0	2746.0	2531.0	2537.0	34340
8-5	217	1200					
		1155	Unit start-up				
		1100	Unit shut-down				
		0900	2741.9	2739.7	2523.9	2530.4	34313
		0830	2741.0	2739.0	2523.0	2530.0	34310
8-4	216	1510	2724.1	2721.9	2506.2	2512.7	34188
		1501	2723.8	2721.7	2505.9	2512.4	34180
		1500	Unit start-up				
		0830	Hand cleaned the membrane stack				
		0800	2722.4	2720.2	2505.3	2511.8	34180
8-3	215	1500	2705.6	2703.4	2488.5	2449.5	34076
		1200	2702.4	2700.3	2485.3	2491.3	34057
		0800	2698.4	2696.3	2481.3	2487.8	34030
8-2	214	1300	2679.0	2677.0	2462.0	2468.0	33910
7-31	212	1300	2633.4	2631.3	2416.4	2423.0	33600
		0800	2629.1	2627.0	2412.5	2419.0	33572
7-30	211	1500					
		1100	Unit start-up				
7-29	210	2300	Unit shut-down				
		1200	2598.0	2595.9	2382.1	2388.6	33367
		1000	2595.8	2593.7	2379.9	2386.4	33350
		0830	2593.8	2591.7	2377.9	2384.4	33330
		0730	Unit start-up				
7-28	209	0700	Hand cleaned the membrane stack				
		1530	Unit start-up				
7-27	208	1300	Unit shut-down				
		0900	2553.0	2551.0	2372.0	2379.0	33270
		0800	2552.8	2550.8	2372.3	2378.8	33176
7-24	205	0800					32780
7-23	204	0806	2464.2	2462.2	2301.4	2307.3	32680
7-22	203	0840	2440.6	2440.6	2277.9	2283.8	32530

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1970	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
7-21	202	0900					32390
		0840					32380
7-20	201	0800					32220
		0730					
7-17	198	0900	2326.1	2328.1	2167.0	2171.8	31780
		0830	2325.8	2327.8	2166.7	2171.5	31770
7-16	197	0900					31620
7-15	196	0900					31450
7-14	195	1500	Unit start-up				
		0800	Hand cleaned the membrane stack				
		0755					31320
7-13	194	0830					31150
7-10	191	0800					30790
7-9	190	1530					30660
		1525	Unit start-up				
		1500	Unit shut-down				
		0800	Unit start-up				
		0700	Unit shut-down				
7-8	189	1530					30450
		1500	Unit start-up				
		0900	Hand cleaned the membrane stack				
7-6	187	0920					30210
7-3	184	0800					29690
		0700	Unit start-up				
7-1	182	1530	Unit shut-down				
		1100					29550
6-30	181	0840					29410
6-29	180	0900					29270
6-26	177	0830					28780
6-25	176	0800					29620
6-24	175	1500					28510
		1455	Unit start-up				
		0700	Hand cleaned the membrane stack				
6-23	174	1230	Unit start-up				
		1100	Unit shut-down				
		0800					28360
6-22	173	0930					28210
6-21	172	1300					28070
6-20	171	1000					27940

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1970	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
6-17	168	0900					27430
		0800	Unit start-up				
6-16	167	1330	Hydraulic operation only				
		0830					27350
6-15	166	0900					27100
6-14	165	1120					26950
6-13	164	1100					
6-12	163	1030					26620
6-11	162	1530	Unit start-up				
		0800	Hand cleaned the membrane stack				
6-9	160	0900					26250
		0800	Unit start-up				
6-8	159	0800	Hydraulic operation only				
6-5	156	0840					25730
6-4	155	0800					25570
6-3	154	0900					25420
6-2	153	0900					25260
6-1	152	0730					25120
		0700	Unit start-up				
5-30	150	2400	Unit shut-down				
		1030					24960
5-28	148	1500					24730
		1455	Unit start-up				
		0720	Unit shut-down				
5-25	145	0800	Unit start-up				
5-22	142	0730	Hand cleaned the membrane stack				
		0720					24230
5-21	141	1100					24180
5-20	140	1200					23930
5-19	139	0900					
		0855	Tightened the membrane stack				
5-18	138	0705					23500
		0700	Tightened the membrane stack				
5-17	137	1120					23480
5-16	136	1130					23420
5-15	135	0800					23350
5-14	134	0900					23100
5-13	133	0900					22980

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1970	Day	Time	Hourly Meter Readings			Chemical Pump	Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump		
5-12	132	1500					22900
5-11	131	0800					22710
5-10	130	1000					
5-9	129	0940					
5-8	128	1330					
		1000					
5-7	127	0930					
		0925	Unit start-up				
		0900	Unit shut-down				
5-6	126	1530	Unit start-up				
		1000	Hand cleaned the membrane stack				
		0930					22140
5-5	125	0815					
5-4	124	1400					
		1000					21740
		0955	Unit start-up				
4-27	117	1300	Unit shut-down				
		0700					21150
4-24	114	0800					
4-23	113	0700					20560
4-22	112	1330					
		0900					20420
4-21	111	1330					
		0900					20260
4-20	110	1410					
		1330	Unit start-up				
		1300	Unit shut-down				
		0900					20110
		0830	Unit start-up				
		0700	Unit shut-down				
4-17	107	1500					
		1330					
		0900					19820
4-16	106	1500					
		1230					
		0900					

TABLE B-6 HOUR METER AND POWER READINGS (CONTINUED)

1970	Day	Time	Hourly Meter Readings				Power K Watts
			Feed Pump	Recirculation Pump	Acid Pump	Chemical Pump	
4-15	105	1500					
		1230					
		0900					19510
		0700	Unit start-up				
4-14	104		Unit shut-down				
4-13	103	1400	Unit start-up				
		1335	Unit shut-down				
		1330					19460
		0700	Unit start-up				
3-20	79	1130	Unit shut-down				
		1030					19450
		1000	Unit start-up				
		0700	Unit shut-down				
3-19	78	1500					
		1200					
		0800					19300
3-18	77	1500					
		1200					
		0800					19140
3-17	76	1500					
		1200					
		0800					18000
3-16	75	1500					
		1200					
		1130	Unit start-up				
		0815	Unit shut-down				
		0800					19870
3-14	73	0830					
3-13	72	1500					
		1200					
		0800					28390
3-12	71	1500					
		1200					

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR JUNE AND JULY, 1971

Hours Rectifier Off	June July	Day of Year	Apparent Reason for Rectifier Shut-down
	June		
3.33	1 Tues	152	Acid flushed the membrane stack.
2.33	3 Thurs	154	Rectifier shut-off to increase amperage.
5.50	4 Fri	155	Acid flushed the membrane stack.
2.50	8 Tues	159	Acid flushed the membrane stack.
0.33	11 Fri	164	Complete shut-down to increase amperage.
6.00	13 Sun	166	Complete shut-down because of high pressure.
1.50	14 Mon	167	Complete shut-down because of high pressure.
2.25			Acid flushed the membrane stack.
7.00			Complete shut-down because of high pressure.
4.00	15 Tues	168	Biz flushed the membrane stack.
5.50	16 Weds	169	Acid flushed the membrane stack.
7.00	17 Thurs	170	Air compressor failure.
7.84	18 Fri	171	Air compressor failure.
2.75	21 Mon	172	Concentration stream pH monitoring system "cycling". Problems in pH electrodes.
2.00			Acid flushed the membrane stack.
1.75	22 Tues	173	Acid flushed the membrane stack.
7.75	23 Weds	174	EDTA flushed the membrane stack.
1.00	24 Thurs	175	Acid flushed the membrane stack.
16.84	25 Fri	176	Hand cleaned the membrane stack.
24.00	26 Sat	177	Complete shut-down.
24.00	27 Sun	178	Complete shut-down.
9.25	28 Mon	179	Complete shut-down.
0.75	29 Tues	180	No influent water.
	July		
3.84	2 Fri	183	Acid flushed the membrane stack.
149.01			Total hours rectifier shut-off.
757.50			Hours in the 32 day period.
608.50			Hours of rectifier operation.
31.50			Average product flow rate-gpm.
1,150,046			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR MAY, 1971

Hours Rectifier Off	May	Day of Year	Apparent Reason for Rectifier Shut-down
0.50	3 Mon	123	CO ₂ from Ion Exchange injected into feed line.
0.50	6 Thurs	126	Air compressor failure.
2.50	9 Sun	129	Air compressor failure.
4.00	11 Tues	131	Acid flushed the membrane stack.
3.50	14 Fri	134	Acid flushed the membrane stack.
3.00	17 Mon	137	Air compressor failure.
7.00	18 Tues	138	Biz-acid flush. Also, took apart filter; one filter down.
0.75	20 Thurs	140	Installed new filter manifold. Instructing night man. Acid too dilute.
4.50	21 Fri	141	Acid flushed the membrane stack.
0.50	23 Sun	143	Air compressor failure.
3.00	24 Mon	144	Air compressor failure.
3.75	25 Tues	145	Acid flushed the membrane stack.
6.50	28 Fri	148	Acid flushed the membrane stack.
40.00			Total hours rectifier shut-off.
768			Hours in 32 day period.
728			Hours of rectifier operation.
31.5			Average product flow rate-gpm.
1,375,920			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR APRIL, 1971

Hours Rectifier Off	April	Day of Year	Apparent Reason for Rectifier Shut-down
3.00	1 Thurs	91	Acid flushed the membrane stack.
3.50	3 Sat	93	Biz flushed the membrane stack.
0.25	5 Mon	95	Rectifier shut-off during dilute acid preparation.
2.00	6 Tues	96	Rectifier shut-off to increase amperage.
4.50	9 Fri	99	Acid flushed the membrane stack.
0.50	12 Mon	102	Rectifier shut-off to increase amperage.
5.80	13 Tues	103	Rectifier shut-off to increase amperage. Also "brine" head of the acid pump was torn down and cleaned.
0.50	14 Weds	104	Rectifier shut-off to increase amperage.
3.25	15 Thurs	105	Acid flushed the membrane stack.
0.25			Air compressor failure.
1.00	17 Sat	107	Rectifier shut-off to increase amperage. After 15 min, complete shut-down.
3.70	19 Mon	109	Backwashed carbon adsorption for 3 hours. Complete shut-down for lack of water.
1.25	20 Tues	110	Complete shut-down to increase amperage.
0.25			Air compressor shut off and a new valve installed for the Ion Exchange plant.
4.42	21 Weds	111	Acid flushed the membrane stack.
0.58	22 Thurs	112	Rectifier shut-off to increase amperage.
17.50	23 Fri	113	Biz flushed the membrane stack. Also, slaker down.
24.00	24 Sat	114	Reactor-clarifier slaker down.
24.00	25 Sun	115	Reactor-clarifier slaker down.
21.00	26 Mon	116	Reactor-clarifier slaker down.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR APRIL, 1971 (CONT'D)

Hours Rectifier Off	April	Day of Year	Apparent Reason for Rectifier Shut-down	
0.25	27	Tues	117	Solu-bridge was calibrated.
2.93	30	Fri	120	Acid flushed the membrane stack.
124.43				Total hours rectifier shut-off.
672.00				Hours in the 28 day period.
547.57				Hours of rectifier operation.
31.50				Average product flow rate-gpm.
1,034,907				Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR MARCH, 1971

Hours Rectifier Off	March	Day of Year	Apparent Reason for Rectifier Shut-down
1.25	1 Mon	60	Complete shut-down to increase amperage.
1.17	2 Tues	61	Complete shut-down, no influent water.
0.50	4 Thurs	63	Heater burnt out in acid pump.
5.00	5 Fri	64	Acid flushed the membrane stack.
9.25			Complete shut-down, cathode stream.
24.00	6 Sat	65	pH monitoring system "cycling".
24.00	7 Sun	66	pH monitoring system "cycling".
8.50	8 Mon	67	pH monitoring system "cycling".
13.00	9 Tues	68	pH monitoring system "cycling".
24.00	10 Weds	69	pH monitoring system "cycling".
24.00	11 Thurs	70	pH monitoring system "cycling".
8.42	12 Fri	71	pH monitoring system "cycling".
.50			Air compressor failure.
2.00	15 Mon	74	Cleaning air system (water).
1.54	18 Thurs	77	Complete shut-down to increase amperage.
4.00			Air compressor failure.
7.00	19 Fri	78	Air compressor failure.
0.33	20 Sat	79	Air compressor failure.
3.25	23 Tues	82	Acid flushed the membrane stack.
1.50	24 Weds	83	Air compressor failure.
2.00	25 Thurs	84	Complete shut-down to increase amperage.
3.33	26 Fri	85	Acid flushed the membrane stack.
1.25			Air compressor repaired.
7.00			Pneumatic controller (on acid pump) failure.
13.50	27 Sat	86	Pneumatic controller failure.
0.83	29 Mon	88	Complete shut-down to increase amperage.
6.00			Pneumatic controller failure.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR MARCH, 1971 (CONT'D)

Hours Rectifier Off	March	Day of Year	Apparent Reason for Rectifier Shut-down	
3.00	30	Tues	89	Pneumatic controller failure.
7.00	31	Weds	90	Pneumatic controller failure.
207.12				Total hours rectifier shut-off.
744.00				Hours in the 31 day period.
536.88				Hours of rectifier operation.
1,014,703				Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR FEBRUARY, 1971

Hours Rectifier Off	February	Day of Year	Apparent Reason for Rectifier Shut-down
24.00	1 Mon	32	Acid pump repairs.
24.00	2 Tues	33	Acid pump and calgon switch repairs.
17.00	3 Weds	34	Alarm system failure. No influent water.
4.75	4 Thurs	35	Acid pump preventive maintenance.
1.00	6 Fri	37	Acid pump preventive maintenance.
1.00	8 Mon	39	Acid pump preventive maintenance.
2.33	9 Tues	40	Power failure.
8.50			Acid pump motor burned out.
16.00	10 Weds	41	Acid pump motor repairs.
1.25	11 Thurs	42	Acid flushed the membrane stack.
14.50			Recarbonation unit not operating.
24.00	12 Fri	43	Recarbonation unit not operating.
24.00	13 Sat	44	Recarbonation unit not operating.
24.00	14 Sun	45	Recarbonation unit not operating.
24.00	15 Mon	46	Recarbonation unit not operating.
14.00	16 Tues	47	Recarbonation unit not operating.
8.50			Recirculation pump failure.
14.50	17 Weds	48	Recirculation pump repairs.
2.02	19 Fri	50	Acid flushed the membrane stack.
8.75			Oil in acid pump motor, removed for repairs.
24.00	20 Sat	51	Acid pump repairs.
24.00	21 Sun	52	Acid pump repairs.
11.00	22 Mon	53	Acid pump repairs.
15.15	23 Tues	54	Acid pump repairs.
17.50	24 Weds	55	Acid pump repairs.
6.00	26 Fri	56	Acid flushed the membrane stack.
331.75			Total hours rectifier shut-off.
672.00			Hours in the 28 day period.
340.25			Hours of rectifier operation.
31.5			Average product flow rate-gpm.
643,073			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR JANUARY, 1971

Hours Rectifier Off	January	Day of Year	Apparent Reason for Rectifier Shut-down
24.00	1 Fri	1	Cathode head of the acid pump down for repairs.
24.00	2 Sat	2	Acid pump repairs.
24.00	3 Sun	3	Acid pump repairs.
24.00	4 Mon	4	Acid pump repairs.
24.00	5 Tues	5	Acid pump repairs.
24.00	6 Weds	6	Acid pump repairs.
7.50	7 Thurs	7	Acid pump repairs.
10.00			Complete shut-down.
24.00	8 Fri	8	Complete shut-down.
24.00	9 Sat	9	Complete shut-down.
24.00	10 Sun	10	Complete shut-down.
24.00	11 Mon	11	Complete shut-down.
8.00	12 Tues	12	Complete shut-down.
6.17			Inspected stack.
1.00	13 Weds	13	Cleaned air signal system.
6.00	14 Thurs	14	Biz flushed the membrane stack.
3.12	15 Fri	15	Acid flushed the membrane stack.
1.00			Cleaned and reprimed acid lines.
10.50			Complete shut-down.
24.00	16 Sat	16	Complete shut-down.
24.00	17 Sun	17	Complete shut-down.
24.00	18 Mon	18	Repairs on cathode side of acid pump.
24.00	19 Tues	19	Acid pump repairs.
24.00	20 Weds	20	Acid pump repairs.
24.00	21 Thurs	21	Acid pump repairs.
24.00	22 Fri	22	Acid pump repairs.
24.00	23 Sat	23	Acid pump repairs.
24.00	24 Sun	24	Acid pump repairs.
24.00	25 Mon	25	Acid pump repairs.
24.00	26 Tues	26	Acid pump repairs.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR JANUARY, 1971 (CONT'D)

Hours Rectifier Off	January	Day of Year	Apparent Reason for Rectifier Shut-down	
15.50	27	Weds	27	Acid pump repairs.
12.00	30	Sat	30	Acid pump failure.
584.79				Total hours rectifier off.
744.00				Hours in the 31 day period.
159.21				Hours of rectifier operation.
31.50				Average product flow rate-gpm.
300,907				Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR DECEMBER, 1970

Hours Rectifier Off	December	Day of Year	Apparent Reason for Rectifier Shut-down
120.00	1 Tues	336	Recarbonation unit repairs.
	through		
	6 Sun	340	
24.00	7 Mon	341	Cathode stream pH monitoring system "cycling".
24.00	8 Tues	342	Repairs on air control system.
9.30	9 Weds	343	Rectifier shut-off.
2.00			Air system repairs (relay).
3.00	10 Thurs	344	Acid pump failure.
2.75			"Calgon" alarm system failure.
12.00			Cathode stream pH monitoring system "cycling".
24.00	11 Fri	345	Repairs on air control system.
24.00	12 Sat	346	Repairs on air control system.
24.00	13 Sun	347	Repairs on air control system.
7.00	14 Mon	348	Repairs on air control system.
2.50			"Calgon" alarm system failure.
3.75			No influent water.
8.00			Repairs on "calgon" alarm system.
13.75	15 Tues	349	Recarbonate unit repairs. No influent water. "Calgon" alarm system repairs.
16.50	16 Weds	350	Hand cleaned the membrane stack.
10.00	17 Thurs	351	Hand cleaned the membrane stack.
1.50			Recarbonation unit failure.
	18 Fri	352	Cathode head of acid pump failure.
	through		
336.00	31 Thurs	365	Acid pump repairs
692.25			Total hours rectifier shut-off.
744.00			Hours in the 31 day period.
51.75			Hours of rectifier operation.
31.50			Average product flow rate-gpm.
97,808			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR NOVEMBER, 1970

Hours Rectifier Off	November	Day of Year	Apparent Reason for Rectifier Shut-down
15.00	5 Thurs through	309	Acid pump repairs. Recarbonation unit repairs.
600.00	30 Mon	334	
615.00			Total hours the rectifier shut-off.
720.00			Hours in the 30 day period.
105.00			Hours of rectifier operation.
31.5			Average product flow rate-gpm.
198,450			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR OCTOBER, 1970

Hours Rectifier Off	October	Day of Year	Apparent Reason for Rectifier Shut-down
10.00	1 Thurs	274	Complete shut-down.
	2 Fri	275	Complete shut-down.
	through		
240.00	11 Sun	284	
8.50	12 Mon	285	Complete shut-down.
10.00			Repairs on acid lines.
8.00	13 Tues	286	Repairs on acid lines.
10.00	20 Tues	293	Complete shut-down.
	21 Weds	294	Complete shut-down.
	through		
120.00	25 Sun	298	
9.84	26 Mon	299	Complete shut-down.
0.5	27 Tues	300	Cathode stream pH monitoring system "cycling".
7.5	28 Weds	301	"Cycling" pH monitoring system.
5.5			"Cycling" pH monitoring system.
429.84	Total hours rectifier shut-off.		
744.00	Hours in the 31 day period.		
314.16	Hours of rectifier operation.		
31.5	Average product flow rate-gpm.		
593,762	Total gallons of product water made in time period.		

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR SEPTEMBER, 1970

Hours Rectifier Off	September	Day of Year	Apparent Reason for Rectifier Shut-down
	1 Tues through	244	Reconstruction in tertiary area.
672.00	28 Mon	271	Reconstruction in tertiary area.
9.00	29 Tues	272	Reconstruction in tertiary area.
1.00	30 Weds	273	Repairs on dilute stream manometer.
682.00			Total hours of rectifier shut-off.
720.00			Hours in the 30 day period.
38.00			Hours of rectifier operation.
31.5			Average product flow rate-gpm.
71,820			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR AUGUST, 1970

Hours Rectifier Off	August	Day of Year	Apparent Reason for Rectifier Shut-down
6.50	4 Tues	216	Hand cleaned the membrane stack.
0.84	5 Weds	217	Repairs on acid lines.
0.17	6 Thurs	218	Complete shut-down to increase amperage.
2.00	11 Tues	223	Repairs in "Calgon" alarm switch.
4.00	13 Thurs	225	Repairs in "Calgon" pump.
0.25	18 Tues	230	Cleaned pH electrodes.
2.00			Concentrating stream pH monitoring system "cycling".
0.50	19 Weds	231	Repairs on electrodes.
1.50	20 Thurs	232	Concentrating stream pH monitoring system "cycling".
14.75	21 Fri	233	Repairs on the pH monitoring system.
24.00	22 Sat	234	Repairs on the pH monitoring system.
24.00	23 Sun	235	Repairs on the pH monitoring system.
8.75	24 Mon	236	Unit operating without pH monitoring system.
17.00	25 Tues	237	Unit operating without pH monitoring system.
13.00	26 Weds	238	Repairs on the pH monitoring system.
15.00	28 Fri	240	Reconstruction in tertiary area.
24.00	29 Sat	241	Reconstruction in tertiary area.
24.00	30 Sun	242	Reconstruction in tertiary area.
24.00	31 Mon	243	Reconstruction in tertiary area.
206.26			Total hours of rectifier shut-off.
744.00			Hours in the 31 day period.
537.74			Hours of rectifier operation.
31.5			Average product flow rate-gpm.
1,016,329			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR JULY, 1970

Hours Rectifier Off	July	Day of Year	Apparent Reason for Rectifier Shut-down
8.50	1 Weds	182	Complete shut-down. Lack of cooling water.
24.00	2 Thurs	183	Complete shut-down. Lack of cooling water.
7.00	3 Fri	184	Complete shut-down. Lack of cooling water.
6.00	8 Weds	185	Hand cleaned the membrane stack.
1.00	9 Thurs	186	Complete shut-down cage switch.
0.42			Complete shut-down. No influent water.
7.00	14 Tues	195	Hand cleaned the membrane stack.
2.00	27 Mon	208	Repairs on the diluting stream flow meter.
24.00	28 Tues	209	Inspection of the membrane stack.
7.50	29 Weds	210	Cleaning of algae from spacers.
1.00			Complete shut-down. No influent water.
11.00	30 Thurs	211	Complete shut-down. No influent water.
99.42			Total hours of rectifier shut-off.
744.00			Hours in the 31 day period.
644.58			Hours of rectifier operation.
31.5			Average product flow rate-gpm.
1,218,256			Total gallons of product water in the time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR JUNE, 1970

Hours Rectifier Off	June	Day of Year	Apparent Reason for Rectifier Shut-down
7.00	1 Mon	152	Repairs in "Calgon" alarm system.
16.00	8 Mon	159	Rectifier shut-off to increase amperage.
8.00	9 Tues	160	Rectifier shut-off to increase amperage.
7.50	11 Thurs	161	Hand cleaned the membrane stack.
10.50	16 Tues	167	Rectifier shut-off to increase amperage.
8.00	17 Weds	168	Rectifier shut-off to increase amperage.
1.50	23 Tues	174	Complete shut-down. No influent water.
7.84	24 Weds	175	Hand cleaned the membrane stack.
1.00	30 Tues	181	Cleaned acid lines and manometer.
67.34			Total hours of rectifier shut-off.
720.00			Hours in the 30 day period.
652.66			Hours of rectifier operation.
31.5			Average product flow rate-gpm.
1,233,527			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR MAY, 1970

Hours Rectifier Off	May	Day of Year	Apparent Reason for Rectifier Shut-down
24.00	1 Fri	121	Complete shut-down. Lack of cooling water.
24.00	2 Sat	122	Complete shut-down. Lack of cooling water.
24.00	3 Sun	123	Complete shut-down. Lack of cooling water.
9.84	4 Mon	124	Complete shut-down. Lack of cooling water.
5.50	6 Weds	126	Hand cleaned the membrane stack.
0.42	7 Thurs	127	Changed cartridge filters.
16.50	22 Fri	142	Hand cleaned the membrane stack.
24.00	23 Sat	143	Complete shut-down.
24.00	24 Sun	144	Complete shut-down.
8.00	25 Mon	145	Complete shut-down.
7.51	28 Tues	148	Complete shut-down.
24.00	31 Sun	151	Complete shut-down.
191.77			Total hours of rectifier shut-off.
744.00			Hours in the 31 day period.
552.23			Hours of rectifier operation.
31.50			Average product flow rate-gpm.
1,043,715			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR APRIL, 1970

Hours Rectifier Off	April	Day of Year	Apparent Reason for Rectifier Shut-down
	1 Weds through	91	Complete shut-down. No influent water.
288.00	12 Sun	102	Complete shut-down. No influent water.
7.00	13 Mon	103	Complete shut-down. No influent water.
0.42			Failure of acid manometer.
10.00	14 Tues	104	Complete shut-down. Lack of cooling water.
7.00	15 Weds	105	Complete shut-down. Lack of cooling water.
1.50	20 Mon	110	Power failure.
0.50			Complete shut-down. No influent water.
11.00	27 Mon	117	Complete shut-down. Lack of cooling water.
24.00	28 Tues	118	Complete shut-down.
24.00	29 Weds	119	Complete shut-down.
24.00	30 Thurs	120	Complete shut-down.
397.42			Total hours of rectifier shut-off.
720.00			Hours in the 30 day period.
322.58			Hours of rectifier operation.
31.5			Average product flow rate-gpm.
609,676			Total gallons of product water made in time period.

TABLE B-7 ELECTRODIALYSIS RECTIFIER LOG FOR MARCH, 1970

Hours Rectifier Off	March	Day of Year	Apparent Reason for Rectifier Shut-down	
12.00	12	Thurs	71	Records start.
3.25	16	Mon	75	Unknown
3.00	20	Fri	79	Air compressor adjustments.
12.50				Complete shut-down. No influent water.
264.00	31	Tues	90	
294.75				Total hours rectifier shut-off.
480.00				Hours in the 20 day period.
185.25				Hours of rectifier operation.
31.50				Average product flow rate-gpm.
350,123				Total gallons of product water made in time period.

APPENDIX C

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across the First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1971										
6 July	M	0800	17,042,230	70	---	9201.8	3,099,300	---	310.2	---
2	F	0736	16,709,080	84	2.9	9197.9	3,099,100	113	310.2	5.1
1	Th	0719	16,588,940	82	3.0	9173.6	3,064,500	---	287.7	6.9
29 June	T	0715	16,378,050	70	3.5	9128.4	3,033,500	429	259.8	0.9
		1000	----	--	---	-----	3,035,900	100	260.2	0.4
		1200	----	--	---	-----	3,046,700	200	261.1	0.9
28	M	0705	16,270,930	62	5.6	9105.1	---	---	---	---
25	F	0707	16,021,780	65	4.2	9040.0	2,992,700	378	256.6	0.3
		1300	----	--	---	-----	3,010,300	172	258.3	1.7
24	Th	0721	15,924,180	68	3.4	9016.3	---	---	---	---
23	W	0714	15,845,470	69	3.2	8997.3	---	---	---	---
22	T	0710	15,743,680	70	3.7	8973.2	---	---	---	---
21	M	0710	15,647,240	57	6.6	8950.5	2,985,900	138	256.6	1.2
18	F	0725	15,382,500	67	3.3	8880.2	---	---	---	---
17	Th	0710	15,315,240	67	3.7	8863.7	---	---	---	---
16	W	0710	15,214,970	68	3.1	8839.7	---	---	---	---
15	T	0710	15,118,330	62	4.5	8816.8	2,976,000	114	255.4	1.7
14	M	0725	15,028,820	62	4.9	8793.6	---	---	---	---
11	F	0702	14,733,970	66	3.8	8721.9	2,964,400	266	254.7	0.6
10	Th	0806	14,639,550	68	3.6	8698.9	---	---	---	---
9	W	0705	14,535,910	69	3.5	8673.9	---	---	---	---
8	T	0731	14,437,220	70	3.3	8650.4	---	---	---	---
7	M	0705	14,333,500	69	3.2	8625.9	---	---	---	---

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1971										
4 June	F	155	0704	14,025,330	70	2.8	8553.9	---	---	---
3	Th	154	0711	13,923,010	69	2.9	8530.0	---	---	---
2	W	153	0747	13,822,120	70	3.0	8506.7	---	---	---
1	T	152	0732	13,723,590	65	3.2	8483.7	2,954,810	254.1	1.1
28 May										
27	F	148	0740	13,328,910	60	6.9	8390.7	2,949,400	253.0	2.0
26	Th	147	0740	13,232,370	69	4.2	8366.7	---	---	---
25	W	146	0822	13,133,130	72	3.1	8343.3	---	---	---
24	T	145	0810	13,033,090	65	4.9	8320.5	2,943,800	251.0	1.3
23	M	144	1100	12,946,830	60	4.7	8299.4	---	---	---
22	F	141	0712	12,630,230	65	4.1	8225.0	2,923,100	268	249.7
21	Th	140	0745	12,534,050	65	5.8	8202.9	2,905,400	286	248.6
20	W	139	0730	12,431,000	72	3.2	8178.5	---	---	---
19	T	138	0720	12,329,120	65	5.1	8155.9	2,886,500	270	247.5
18	M	137	0905	12,236,210	70	4.6	8133.7	---	---	---
17	F	134	0730	11,928,340	68	5.7	8062.6	2,862,200	275	246.0
16	Th	133	0730	11,876,300	72	4.3	8038.7	---	---	---
15	W	132	0730	11,721,490	72	3.5	8014.8	---	---	---
14	T	131	0715	11,619,170	65	4.5	7992.0	2,849,000	282	245.2
13	M	130	0800	11,523,310	70	4.4	7969.1	---	---	---
12	F	127	0730	11,203,450	65	5.5	7897.4	2,825,300	272	243.8
11	T	124	0730	10,904,920	73	3.4	7827.9	---	---	---

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash	
1971											
30 April	F	120	0730	10,472,670	75	3.9	7733.2	2,804,100	278	242.5	1.3
29	Th	119	0730	10,368,960	70	4.0	7710.5	2,782,400	278	241.2	1.3
28	W	118	0730	10,264,240	75	4.4	7686.7	----	----	----	----
27	T	117	0730	10,163,330	75	5.6	7664.1	2,760,700	292	239.9	1.0
26	M	116	2100	Start-up							
23	F	113	0730	10,111,010	55	7.8	7651.3	----	----	----	----
		1200	Shut-down								
22	Th	112	0730	10,018,790	67	5.8	7629.2	2,743,200	278	238.9	1.0
21	W	111	0730	9,912,730	75	3.5	7604.8	----	----	----	----
20	T	110	0725	9,806,660	75	3.2	7581.8	2,726,500	287	237.9	1.4
19	M	109	0730	9,706,990	30	12.9	7559.6	2,702,400	----	236.5	1.4
16	F	106	0730	9,439,590	74	5.6	7488.7	2,701,900	285	235.1	1.0
15	Th	105	0730	9,337,570	74	5.3	7466.7	2,684,800	290	234.1	1.5
14	W	104	0730	9,230,560	77	3.9	7443.8	2,658,700	294	232.6	1.05
13	T	103	0735	9,120,900	77	3.9	7420.8	2,640,200	285	231.5	1.1
12	M	102	0735	9,021,830	70	4.9	7398.5	2,621,400	275	230.4	1.2
9	F	99	0715	8,680,670	78	3.2	7327.3	2,601,600	239	229.2	1.1
8	Th	98	0730	8,570,650	80	2.9	7304.7	2,582,800	299	228.1	1.1
7	W	97	0800	8,456,520	80	3.1	7782.6	2,563,100	315	227.0	1.3
6	T	96	0800	8,344,870	80	3.4	7259.5	2,538,500	286	225.7	1.0
5	M	95	0800	8,246,500	62	5.1	7240.0	2,521,350	284	224.7	1.2
2	F	92	0800	7,965,940	65	4.7	7168.9	2,500,900	260	223.5	1.0

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1971										
31 Mar	W	90	0850	7,878,290	70	4.3	7147.7	2,485,300	292	222.5
30	T	89	0820	7,787,400	67	3.6	7128.8	2,464,300	312	221.3
29	M	88	0810	7,690,090	72	3.6	7103.2	2,443,700	282	220.2
28	Sun	87	0825	7,584,590	70	5.4	7080.6	2,364,500	---	214.8
26	F	85	0930	Backwashed third column	70	4.0	7011.4	2,416,600	140	218.6
25	Th	84	0730	7,320,840	70	3.1	6980.6	---	---	---
24	W	83	0730	7,208,750	70	3.7	6964.3	---	---	---
23	T	82	0800	7,113,040	70	3.5	6943.0	2,316,200	314	212.0
22	M	81	0830	7,018,530	50	8.8	6920.9	2,324,200	267	212.5
19	F	78	0800	6,926,770	70	3.3	6849.6	2,295,600	---	210.9
18	Th	77	0815	6,652,360	70	3.0	6827.2	2,256,100	---	---
17	W	76	0810	6,555,050	70	4.8	6804.4	2,233,300	---	207.3
16	T	75	0810	6,456,450	70	2.9	6780.2	2,213,700	326	206.2
15	M	74	0820	6,359,480	70	3.5	6757.7	2,189,250	323	204.9
12	F	71	0730	6,265,490	70	3.1	6686.5	---	---	---
11	Th	70	1400	5,964,880	70	3.0	6670.0	2,169,900	329	203.9
10	W	69	1300	5,894,810	70	---	6646.5	2,149,200	286	202.8
9	T	68	0900	5,795,400	65	---	6619.7	---	---	---
8	M	67	0730	5,685,060	65	---	6601.7	2,128,600	227	201.6
			Start up							
			1500	5,610,710	65	---		---	---	---

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psf Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1971										
5 Mar	F	0810	5,561,370	65	---	6589.5	2,117,700	307	200.8	1.4
		1530	Shut down							
4	Th	0815	5,482,470	50	4.4	6570.8	2,091,850	328	199.4	1.05
3	W	0750	5,285,840	60	3.2	6546.8	---	---	---	---
2	T	0750	5,283,840	60	4.0	6524.4	2,071,200	325	198.3	1.9
1	M	0745	5,185,500	60	3.3	6500.0	---	---	---	---
26 Feb	F	0800	4,899,670	60	---	6434.6	2,034,200	---	196.4	6.6
25	Th	0730	4,801,060	60	2.3	5411.0	1,930,900	329	190.8	1.0
24	W	0730	4,707,980	68	2.2	6389.2	1,911,150	315	181.8	2.4
23	T	0845	4,620,820	60	1.9	6368.7	1,865,800	329	187.4	2.8
22	W	0800	4,526,740	53	6.4	6346.3	1,810,550	325	184.6	1.5
19	F	0730	4,271,330	52	4.0	6276.4	1,781,300	296	183.1	1.1
18	Th	0740	4,186,890	59	5.5	6253.6	1,761,800	310	182.0	1.0
17	W	0735	4,098,760	68	3.2	6230.8	---	---	---	---
16	T	0735	4,025,150	59	12.2	6213.5	1,743,200	294	181.0	6.6
11	Th	0735	3,710,850	55	5.1	6121.2	---	---	---	---
10	W	0880	3,622,650	60	2.4	6097.4	---	---	---	---
9	T	0815	3,539,490	60	5.3	6075.5	1,626,800	293	174.4	4.25
8	M	0735	3,447,280	60	4.5	6050.8	---	---	---	---
5	F	0750	3,197,430	58	6.4	5980.2	1,552,000	286	170.0	6.1
4	Th	0815	3,126,300	60	4.2	5961.0	---	---	---	---
3	W	0730	3,069,000	60	4.0	5945.6	1,447,250	---	163.9	0.5
		0800	Shut down							
		1600	Start up							

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1971										
2 Feb 1	T 33	0800	2,983,050	60	2.3	5922.1	----	---	----	---
	M 32	1500	Start up			5918.6	1,440,200	200	163.4	7.1
30	S 30	1200	Shut down			5918.6	----	---	----	---
29	F 29	0730	2,882,370	60	7.4	5890.1	----	---	----	---
28	Th 28	0720	2,794,370	60	2.8	5866.4	----	---	----	---
27	W 27	0845	2,727,160	60	5.7	----	1,393,500	200	----	4.8
26	T 26	0740	2,642,320	60	3.5	----	----	---	----	---
25	M 25	0800	Start up							
22	F 22	0930	Second Column				1,280,700	219	----	3.0
		1145	First Column				1,336,100	253	----	3.65
21	Th 21	1520	Shut down							
19	T 19	1700	2,552,070	60	----	----	1,238,100	137	----	3.25
15	F 15	0730	2,544,650	30	----	----	----	---	----	----
		0730	2,425,100	60	2.7	----	----	---	----	----
14	Th 14	0730	2,360,470	57	2.8	----	1,211,300	218	----	6.6
13	W 13	0730	2,272,550	63	2.7	----	----	---	----	----
12	T 12	0730	2,185,460	58	2.2	----	----	---	----	----
11	M 11	0730	2,113,160	55	3.3	----	1,125,100	205	----	3.25
8	F 8	0810	1,870,430	50	2.0	----	----	---	----	----
7	Th 7	0800	1,802,380	35	2.5	----	1,085,200	201	----	3.40
6	W 6	0720	Began operation in first-secondary-third column mode							
			1,747,280	55			1,044,100	269	----	3.25
5	T 5	0720	Refilled first column with regenerated carbon							

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1970										
31 Dec	Th	365	0710	1,649,480	60	---	---	---	---	---
21	M	355	0800	1,588,250	--	Start up	---	---	---	---
18	F	352	0735	1,560,690	55	---	---	---	---	---
17	Th	351	0715	1,588,250	--	Shut down	---	---	---	---
15	T	349	0830	1,489,380	60	---	---	---	---	---
			1415	1,348,640	--	Shut down	---	---	---	---
14	M	348	0930	1,289,860	50	---	973,800	292	---	3.0
11	F	345	0730	1,034,090	47	---	921,300	---	---	---
10	Th	344	0730	952,060	50	---	---	---	---	---
9	W	343	0830	873,060	60	---	---	---	---	---
8	T	342	0740	789,860	60	---	---	---	---	---
7	M	341	0730	705,750	60	---	---	---	---	---
4	F	338	1245	470,013	--	---	---	---	---	---
9 Nov	M	313	0800	Began operation using second and third columns						
6	F	310		Loaded 4800 lbs virgin activated carbon into second column						
5	Th	309	0800	19,913,880	--	---	---	---	---	---
				Emptied first column						
3	T	307	0800	19,758,788	--	---	---	---	---	---
2	M	306	0800	19,673,586	--	---	---	---	---	---

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1970										
29 Oct	Th	0800	19,417,980	--	---	---	---	---	---	---
28	W	0800	19,245,120	--	---	---	---	---	---	---
27	T	0800	19,146,110	--	---	---	---	---	---	---
26	M	0800	19,048,360	--	---	---	---	---	---	---
21	W	0810	18,718,110	69	---	4713.0	---	---	---	---
20	T	0810	18,619,180	70	---	4689.0	855,500	143	116.0	---
19	M	1100	-----	--	---	4689.0	---	---	---	---
18	Sun	1430	18,563,280	45	---	4668.0	---	---	---	---
17	S	0830	18,478,140	50	---	4638.4	---	---	---	---
16	F	0845	18,390,030	70	0.0	4614.7	---	---	---	---
15	Th	1500	18,316,170	70	0.0	4597.2	684,100	164	96.0	1.5
11	Sun	0830	-----	--	---	4542.2	---	---	---	---
10	S	1030	18,168,740	70	---	4538.5	---	---	---	---
6	T	0810	18,097,890	--	---	4531.2	669,300	150	94.5	3.2
1	Th	0810	18,069,110	60	---	4523.0	---	---	---	---
		0810	Shut-down							
30 Sept	W	0815	17,976,850	73	---	4500.0	---	---	---	---
29	T	0730	17,879,290	73	---	4475.0	---	---	---	---
28	M	0800	17,788,780	73	---	4452.0	---	---	---	---
25	F	0830	17,474,270	75	---	4381.8	---	---	---	---
24	Th	1000	17,389,510	70	---	4361.2	---	---	---	---

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1970 28 Aug	F 240	0930	17,385,310	70	---	4359.0	----	---	----	---
27	Th 239	0930	Shut down							
26	W 238	0830	17,287,060	70	---	4335.0	----	---	----	---
25	T 237	0900	17,190,300	70	---	4312.0	----	---	----	---
24	M 236	0930	17,097,940	70	---	4289.0	----	---	----	---
22	S 234	0900	16,897,120	70	0.0	4264.0	----	---	----	---
21	F 233	0800	16,892,730	70	1.0	----	----	---	----	---
20	Th 232	0800	16,791,190	50	1.0	4197.0	640,500	171	91.3	2.5
19	W 231	0830	16,618,880	60	2.0	4173.0	----	---	----	---
18	T 230	0900	16,531,760	70	0.0	4150.0	----	---	----	---
17	M 229	0900	16,444,280	70	0.0	4128.0	----	---	----	---
16	Sun 228	0900	16,332,230	70	1.0	4102.0	----	---	----	---
15	S 227	0800	16,224,710	70	1.0	----	----	---	----	---
14	F 226	0900	16,129,000	70	1.0	----	----	---	----	---
13	Th 225	0810	16,022,380	70	1.0	4029.0	----	---	----	---
12	W 224	0915	15,920,560	70	2.0	4006.0	----	---	----	---
11	T 223	0815	15,815,070	70	2.0	3981.0	----	---	----	---
10	M 222	0840	15,714,410	70	2.0	3958.0	----	---	----	---
9	Sun 221	0800	15,614,000	70	2.0	3934.0	----	---	----	---
8	S 220	1400	15,533,320	70	2.0	3915.0	----	---	----	---
7	F 219	1300	15,416,320	70	2.0	3900.0	----	---	----	---
6	Th 218	0820	15,304,780	70	2.0	3862.0	----	---	----	---
5	W 217	0830	15,200,370	70	2.0	3838.0	----	---	----	---
		0820	15,096,210	70	2.0	3814.0	----	---	----	---

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1970										
4 Aug	T 216	0800	15,023,910	70	0.0	3797.0	614,800	254	88.8	4.5
3	M 215	0845	14,927,320	70	0.0	3773.7	----	----	----	----
2	Sun 214	1300	14,841,670	70	0.0	3754.0	----	----	----	----
1	S 213	1315	14,751,940	70	0.0	3730.0	----	----	----	----
31 July	F 212	0812	14,646,660	70	1.0	3702.1	----	----	----	----
30	Th 211	1340	14,565,210	70	0.0	3683.3	----	----	----	----
29	W 210	0820	14,489,530	70	0.0	3663.9	----	----	----	----
28	T 209	0800	14,387,540	70	1.0	3639.0	----	----	----	----
27	M 208	0900	14,295,160	75	1.0	3616.0	----	----	----	----
26	Sun 207	0800	14,188,320	75	1.0	3591.0	----	----	----	----
25	S 206	0730	14,089,210	70	1.0	3567.2	----	----	----	----
24	F 205	0800	14,012,180	70	----	3551.0	546,100	209	84.3	5.7
23	Th 204	0815	-----	70	1.0	3526.0	----	----	----	----
22	W 203	0830	13,883,690	70	2.0	3508.0	----	----	----	----
21	T 202	0800	13,737,560	70	0.0	3478.0	----	----	----	----
20	M 201	0800	13,640,480	70	1.0	3453.0	----	----	----	----
19	Sun 200	0800	13,546,060	70	1.0	3429.7	----	----	----	----
18	S 199	0730	13,451,160	70	0.0	3405.5	----	----	----	----
17	F 198	0900	13,371,100	70	0.0	3385.0	----	----	----	----
16	Th 197	0900	13,276,810	65	2.0	3362.0	474,500	150	78.5	3.3
15	W 196	0900	13,187,600	65	1.0	3338.0	----	----	----	----
14	T 195	0830	13,087,700	70	1.0	3313.0	----	----	----	----
13	M 194	0830	12,991,750	65	1.0	3289.0	----	----	----	----
12	Sun 193	0730	12,893,220	65	2.0	3265.0	----	----	----	----

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1970										
11 July	S 192	0920	12,802,840	70	2.0	3242.0	----	---	---	---
10	F 191	0850	12,703,130	65	2.0	3218.0	----	---	---	---
9	Th 190	0800	12,595,240	60	2.0	3193.0	----	---	---	---
8	W 189	1600	12,533,710	65	3.0	3177.0	444,800	161	75.3	4.1
7	T 188	0900	12,434,570	70	0.0	3152.0	----	---	---	---
6	M 187	0940	12,333,510	70	0.0	3127.8	----	---	---	---
5	Sun 186	0800	12,233,050	70	0.0	3104.0	----	---	---	---
4	S 185	0800	12,140,060	70	2.0	3080.6	----	---	---	---
3	F 184	0755	12,035,860	--	2.0	3055.3	----	---	---	---
1	W 182	0900	11,938,720	70	1.0	3032.8	----	---	---	---
30 June	T 181	0830	11,853,360	70	1.0	3014.0	----	---	---	---
29	M 180	0750	11,759,840	80	0.0	2991.2	405,200	267	71.2	---
26	F 177	0810	11,458,320	80	0.0	2919.6	----	---	---	---
25	Th 176	0810	11,352,100	65	2.0	2897.8	----	---	---	---
24	W 175	0800	11,260,810	65	2.0	2873.0	----	---	---	---
23	T 174	0800	11,175,990	55	3.0	2850.1	----	---	---	---
22	M 173	0930	-----	--	2.0	-----	378,000	215	69.5	2.3
21	Sun 172	0900	11,083,340	70	0.0	2827.4	----	---	---	---
20	S 171	1300	10,992,350	70	1.0	2807.1	----	---	---	---
19	F 170	1100	10,886,320	70	2.0	2781.8	----	---	---	---
18	Th 169	0800	10,788,000	65	2.0	2756.7	----	---	---	---
17	W 168	0840	10,707,620	70	4.0	2733.3	----	---	---	---
			10,608,010	65	3.0	2709.7	348,400	151	67.2	1.4

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1970										
16 June	T 167	0805	10,497,450	65	3.0	2686.5	---	---	---	---
15	M 166	0840	10,405,640	70	1.0	2663.3	---	---	---	---
12	F 163	0845	10,081,380	70	0.0	2592.4	---	---	---	---
11	Th 162	0800	9,975,060	70	0.0	2568.4	---	---	---	---
10	W 161	1440	9,899,030	70	0.0	2551.1	---	---	---	---
9	T 160	0745	9,793,890	70	1.0	2526.1	---	---	---	---
8	M 159	0800	9,693,600	70	1.0	2502.3	---	---	---	---
5	F 156	0810	9,422,490	60	2.0	2432.0	---	---	---	---
4	Th 155	0740	9,334,270	60	2.0	2407.4	---	---	---	---
3	W 154	0820	9,246,760	70	2.0	2384.1	---	---	---	---
2	T 153	0800	9,165,870	60	2.0	2359.7	---	---	---	---
1	M 152	0850	9,082,090	70	1.0	2336.7	---	---	---	---
31 May	Sun 151	1055	8,993,660	70	0.0	2314.7	---	---	---	---
30	S 150	1010	8,894,900	70	1.0	2290.0	---	---	---	---
29	F 149	1300	8,801,550	--	2.0	2269.0	---	---	---	---
28	Th 148	0810	8,744,040	--	2.0	2254.9	---	---	---	---
27	W 147	0735	8,649,790	70	2.0	2231.0	---	---	---	---
26	T 146	0825	8,563,160	75	2.0	2208.0	330,600	260	65.8	2.5
25	M 145	0822	8,461,330	75	1.0	2186.7	---	---	---	---
24	Sun 144	0905	8,366,530	30	0.0	2163.5	---	---	---	---
23	S 143	1030	8,260,760	80	1.0	2140.9	291,700	150	63.3	1.7
22	F 142	0715	8,164,660	70	0.0	2097.4	---	---	---	---
21	Th 141	0845	8,068,670	70	0.0	2097.4	---	---	---	---

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1970										
20 May	W 140	0810	7,973,140	68	1.0	2072.7	----	----	----	----
19	T 139	1100	7,896,620	75	2.0	2051.2	----	----	----	----
18	M 138	1100	7,788,710	75	2.0	2027.9	----	----	----	----
17	Sun 137	1020	7,678,310	70	0.5	-----	----	----	----	----
16	S 136	1040	7,579,490	40	0.0	1979.9	----	----	----	----
15	F 135	0840	7,478,500	70	1.0	1954.0	----	----	----	----
14	Th 134	0845	7,376,700	66	1.0	1930.0	----	----	----	----
13	W 133	0820	7,284,300	68	1.0	1908.0	----	----	----	----
12	T 132	0805	7,187,530	68	1.0	1884.0	----	----	----	----
11	M 131	0900	7,101,000	70	2.0	1861.0	----	----	----	----
8	F 128	0835	6,808,570	70	2.0	1789.0	----	----	----	----
7	T 127	0810	6,708,580	70	2.0	1764.0	----	----	----	----
6	W 126	0830	6,610,430	70	2.0	1741.0	----	----	----	----
5	T 125	0810	6,508,940	70	2.0	1716.0	----	----	----	----
4	M 124	0845	6,411,070	00	0.0	1694.0	----	----	----	----
1	F 121	1500	6,228,660	70	2.0	1651.0	277,300	----	----	----
30 Apr	Th 120	-----	-----	--	---	-----	----	300	61.6	2.3
29	W 119	0800	6,218,370	70	2.0	1648.0	----	----	----	----
28	T 118	0800	6,119,400	70	2.0	1625.0	----	----	----	----
27	M 117	0800	6,014,370	70	2.0	1601.0	----	----	----	----
24	F 114	0800	5,706,410	70	2.0	1532.0	----	----	----	----
23	Th 113	0900	5,604,435	70	2.0	1509.0	----	----	----	----
22	W 112	0800	5,498,080	70	2.0	1484.0	----	----	----	----

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1970										
21 Apr	T 111	0910	5,399,890	70	2.0	1461.5	----	---	---	---
20	M 110	0830	5,301,160	70	2.0	1438.1	----	---	---	---
16	Th 106	0845	4,885,550	75	2.0	1342.3	----	---	---	---
15	W 105	1430	4,800,470	75	2.0	1324.3	----	---	---	---
14	T 104	0735	4,768,670	00	0.0	1316.7	----	---	---	---
13	M 103	1230	4,743,140	70	2.0	1306.0	----	---	59.3	---
20 Mar	F 79	0830	4,727,220	70						
19	Th 78	1130	Shut down							
18	W 77	0800	4,617,690	70	1.0	1276.3	----	---	---	---
17	T 76	0730	4,505,300	70	1.0	1251.7	----	---	---	---
16	M 75	1200	4,412,300	70	2.0	1231.8	----	---	---	---
13	F 72	0800	4,281,170	80	2.0	1203.8	----	---	---	---
11	W 70	0730	3,941,060	80	2.0	1131.4	----	---	---	---
10	T 69	0730	3,794,700	70	4.0	1103.1	239,000	300	13.7	2.1
9	M 68	0730	3,794,700	00	0.0	1103.1	----	---	---	---
6	F 65	0830	3,620,300	55	2.0	1053.0	----	---	---	---
4	W 63	0730	3,447,430	55	2.0	1003.4	----	---	---	---
3	T 62	0830	3,366,600	55	2.0	980.7	----	---	---	---
2	M 61	0800	3,279,420	60	2.0	956.1	----	---	---	---

TABLE C-1 CARBON ADSORPTION PRODUCT AND BACKWASH GALLONS WITH PUMP HOUR READINGS AND PRESSURE
ACROSS THE FIRST COLUMN

Date	Day of Year	Time	Gallons of Product	gpm	psi Across The First Column	Feed Pump Hours	Gallons of Backwash	gpm	Pump Hours	Hours of Backwash
1970										
25 Feb	M	1690	2,860,070	60	2.0	843.4	---	---	---	---
24	T	0800	2,777,320	60	2.0	819.3	---	---	---	---
16	M	0730	2,097,880	60	2.0	627.4	---	---	---	---
11	W	1700	Start up							
10	W	0800	1,695,330	40	4.0	516.5	---	---	---	---
		1000	Shut down	--	---	---	202,500	300	11.6	1.90
9	M	0800	1,625,480	10	9.0	496.4	---	---	---	---
		1130	---	--	---	---	169,600	300	9.7	2.40
3	T	1145	1,192,450	60	2.0	359.1	---	---	---	---
		1400	---	--	2.0	---	127,300	300	7.3	1.10
2	M	0800	1,095,480	40	2.0	332.3	---	---	---	---
		1330	1,111,130	40	2.0	337.8	108,900	300	6.2	1.75
23 Jan	F	0800	309,880	60	0.5	93.0	---	---	---	---
22	Th	1400	251,110	60	0.5	75.7	78,100	---	4.5	---
19	M	1400	---	--	---	3.7	---	---	---	---

APPENDIX D

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 1

1971	Sample Day Hours		micro- Temp. mhos/cm °C at 25°C		pH	Analysis as mg/l Alkalinity				
						Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
6-30	181	18	21.5	1659	7.9	131.3	160.2		253.3	435
6-29	180	24	22		7.6	126.4	154.2			
6-28	179	24	23	1633	7.7	142.8	174.2			
6-24	175	24	19		8.1	138.5	169.0			
6-23	174	24	25	1530	8.6	152.6	153.0	16.3		
6-22	173	24	21		8.3	131.8	149.1	5.8		
6-21	172	24	25	1650	7.8	169.4	206.7			
6-17	168	24	18		8.0	158.0	192.8			
6-16	167	24	17	1652	8.4	151.3	172.9	5.8		
6-15	166	24	16		8.2	169.4	206.7			
6-14	165	24			8.3	180.8	216.7	1.9		
6-10	161	24	20	1705	8.0	140.1	170.9			
6-9	160	24	20	1710	8.3					
6-8	159	24	20		8.5	102.6	121.3	1.9		
6-7	158	24	21	1728	8.3	149.8	175.0	3.8		
6-3	154	24	22		8.6	87.8	95.4	5.8		
6-2	153	24	22	1696	7.9	138.5	169.0			
6-1	152	24	18		8.1	166.2	202.8			
5-31	151	24	18	1760	8.4	162.6	178.9	19.6		
5-27	147	24	15		9.3	138.1	145.1	11.5		
5-26	146	24	17	1746	7.7	175.9	214.6			
5-25	145	24	15		7.7	179.2	218.6			
5-24	144	24	25	1710	7.6	149.9	182.9			
5-20	140	7.5	19		8.0	195.1	238.0			
5-19	139	24	23	1810	7.9	212.2	258.9			
5-17	137	19	19	1808	7.8	195.0	237.9			
5-13	133	24	19		7.9	200.3	244.4			
5-12	132	24	24	1836	7.9					
5-11	131	24	22		7.8	216.0	263.5			
5-10	130	24	20	1848	7.3					
5-6	126	24	18		8.0	195.1	238.0			
5-5	125	24	21	1804	7.8	180.6	220.3			
5-4	124	24	20		8.0	166.1	202.6			
5-3	123	24	19	1785	7.8	181.4	221.3			

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 1
(CONTINUED)

1971	Day	Hours	Temp °C	micro- mhos/cm at 25°C	pH	Analysis as mg/l Alkalinity				
						Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
4-29	119	24	20		7.4					
4-28	118	24	19	1808	7.1					
4-26	116	24	22	1770	7.6	254.0	309.9			
4-22	112	24	21		7.6	231.7	282.7			
4-21	111	24	23	1789	7.9	201.0	245.2			
4-20	110	24	22		8.0	201.0	245.2			
4-19	109	24	21	1804	7.0	200.0	244.0			
4-15	105	24	21		8.0	158.4	193.3			
4-14	104	24	21	1696	8.0	170.4	207.9			
4-13	103	24	23		8.3	197.0	235.7	2.9		
4-12	102	24	20	1804	8.4	172.8	205.0	2.9		
4-8	98	24	23		7.9	151.0	184.2			
4-7	97	24	23	1799	7.5	140.4	171.3			
4-6	96	24	24		7.5	138.0	168.4			
4-5	95	24	21	1750	7.5	148.8	181.5			
3-31	90	24	15	1796	7.5	165.5	201.9			
3-30	89	24	22		8.1	193.0	235.5			
3-29	88	17	23	1778	7.8	242.3	295.6			
3-25	84	24	25	1760	7.8	214.0	261.1			
3-24	83	24	23	1830	7.6	206.5	251.9		246.5	440
3-23	82	24	22		7.9	205.2	250.3			
3-22	81	24	21	1836	7.7	233.0	284.3			
3-18	77	24	19		8.0	208.0	253.8			
3-17	76	24	18	1840	7.7	198.6	242.3		259.2	360
3-16	75	24	21		8.0	193.0	235.5			
3-15	74	24	20	1815	7.8	206.5	251.9		259.2	370
3-11	70	24	20		8.2	209.0	255.0			
3-9	68	24	22		7.6	195.0	237.9			
3-4	63	24	20		8.0	194.6	237.4			
3-3	62	24	24	1737	7.8	213.2	260.1		249.4	380
3-2	61	24	24		7.7	230.0	280.6			
3-1	60	24	21	1804	7.6	244.9	298.8		259.2	370

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 1
(CONTINUED)

Sample				Analysis as mg/l						
				micro- mhos/cm at 25°C	pH	Alkalinity				
1971	Day	Hours	Temp °C			Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
2-25	56	24	20		7.7	229.0	279.4			
2-24	55		18	1702	7.6	229.1	279.5		251.4	345
2-23	54	24	23		7.4	241.0	294.0			
2-22	53	24	21	1793	7.6	206.5	251.9		254.4	380
2-18	49	24	22		7.6	253.0	308.7			
2-17	48	24	16	1734	7.6	273.0	333.1		245.5	370
2-16	47	21	18		8.2	300.0	366.0			
2-15	46	24			8.5	277.6	313.5	12.4		
2-10	41	24	21	1739	9.1	92.6	102.4	47.2	265.0	340
2-9	40	24	20		7.8	227.0	277.0			
2-8	39	24	16	1680	9.1	160.4	135.9	29.4	250.0	370
2-4	35	18	21	1328	9.9	237.0				
2-3	34	13	21	1450	10.1	117.2	5.9	67.3	243.0	350
2-2	33	24	21		9.1	264.0				
1-28	28	24	18		9.3	231.0				
1-27	27	24	15	1587	9.4	147.8	96.5	41.2	260.0	400
1-26	26	24	25		9.2	212.0				
1-25	25	24	19	1446	8.9	129.3	107.7	24.6	260.0	
1-14	14	24	21		8.0	138.0	168.4			
1-13	13	19	17	1723	7.7	142.2	173.5		252.0	350
1-12	12	19	21		8.0	209.0	255.0			
1-11	11	24	21	1674	8.6	203.0				
1-7	7	24	18		8.5	224.0				
1-6	6	24			8.6	140.8	127.8	7.8	249.0	345
1-5	5	24	18		8.1	186.0	227.0			
1-4	4	22	23	1633	8.9	229.2	225.7	26.5	248.0	355

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 1
(CONTINUED)

Sample		Temp		micro- mhos/cm at 25°C	pH	Analysis as mg/l Alkalinity					Cl	SO ₄
1970	Day Hours	°C				Total as CaCO ₃	HCO ₃	CO ₃				
12-30	364	15	20	1678	9.0	275.0					257.0	310
12-22	356	24	19		8.8	262.0						
12-17	351	24	20		9.4	258.0						
12-16	350	24	20	1650	8.9	266.0						
12-15	349	18	22		9.3	266.0						
12-14	348	24	20	1540	9.4	215.0						
12-10	344	24	19	1550	9.4	217.0						
12-9	343	24	16	1428	9.5	182.0					247.4	400
12-8	342	24	22		9.0	221.0						
12-7	341	24	23	1612	8.5	225.0						
11-13	317	24	23		7.3	222.0	270.8					
11-5	309		24		8.4							
11-3	307	24	23	1570	7.8	197.0	240.3					
11-2	306	24	16	1620	7.2	197.0	240.3					
10-29	302	24	17		7.3	191.0	233.0					
10-28	301	24	19	1706	7.0	185.3	226.1				228.8	310
10-27	300	24	19		7.3	194.0	236.7					
10-26	299	24			7.3	216.0	263.5				234.0	312
10-21	294		24	1660								
10-20	293		25	1520	7.7	194.0	236.7				234.0	385
10-15	288	24	25		7.3	205.0	250.1					
10-12	285	24	26	1568	7.7	211.0	257.4				211.0	320
10-9	282		25	1670	7.3	225.0	274.5				247.0	265
9-30	273		24	1571	7.6	220.0	268.4				227.0	360

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 1
(CONTINUED)

Sample			Temp °C	micro- mhos/cm at 25°C	pH	Analysis as mg/l Alkalinity				
1970	Day	Hours				Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
8-27	239	24	26		7.3	109.0	133.0			
8-26	238	24	18	1530	7.5	126.3	154.1		217.9	375
8-25	237	24	23		8.1	144.0	175.7			
8-24	236	24	22	1643	7.5	105.2	128.3		230.0	420
8-20	232	24	19		7.6	173.0	211.1			
8-19	231	24	20	1628	7.7	274.0	334.3		228.0	360
8-18	230	24	20		7.4	171.0	208.6			
8-17	229	24	20	1584	7.5	104.0	126.9		242.0	385
8-13	225	24			7.1	108.0	131.8			
8-12	224	24	20	1562	7.1	104.0	126.9		233.0	366
8-11	223	24			7.0	111.0	135.4			
8-10	222	24	18	1311	7.2	137.0	167.1		245.0	380
8-6	218	24			7.2	167.0	203.7			
8-5	217	24			7.2					
8-4	216	24			7.2	163.0	198.9			
8-3	215	24			7.7					
7-30	211	24			7.3	136.0	165.9			
7-28	209	24			9.0	136.0	165.9			
7-27	208	24			7.5					
7-23	204	24			7.1	97.0	118.3			
7-22	203	24			7.2					
7-21	202	24			7.4	91.0	111.0			
7-20	201	24			8.4					
7-16	197	24			7.4	126.0	153.7			
7-15	196	24			6.8					
7-14	195	24			6.6	111.0	135.4			
7-13	194	21.5			7.2					
7-9	190	24			7.0					
7-8	189	24			9.3	143.0				
7-7	188	24			7.3					
7-6	187	24			7.4	180.0	219.6			

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 1
(CONTINUED)

Sample				Analysis as mg/l						
1970	Day	Hours	Temp °C	micro- mhos/cm at 25°C	pH	Alkalinity				
						Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
6-30	181	24			7.1					
6-29	180	24			7.4	175.0	213.5			
6-25	176	24			7.7					
6-24	175	24			7.2	110.0	134.2			
6-23	174	24			7.1					
6-22	173	24			8.4	163.0				
6-18	169	24			8.3					
6-17	168	24			7.3	182.0	222.0			
6-11	162	24			6.9					
6-10	160	24			6.9					
6-9	159	24			7.5	138.0	168.4			
6-4	155	24			6.8					
6-3	154	24			7.0	138.0	168.4			
6-2	153	24			8.0					
5-27	147	24			8.8	134.0				
5-26	146	24			7.2					
5-25	145	24			7.2	118.0	144.0			
5-21	141	24			7.3					
5-20	140	24			7.4	123.0	150.1			
5-19	139	24			7.2	148.0	180.6			
5-14	134	24			8.4					
5-13	133	24			7.8					
5-11	131	24			8.0					
5-6	126	24			7.4					
5-5	125	24			7.3					
5-4	124	24			7.4					
4-28	118	24			7.3	136.0	165.9			
4-27	117	24			8.0					
4-26	116	24			8.2					
4-23	113	24			7.6	143.0	174.5			
4-22	112	24			7.3					
4-21	111	24			8.9	145.0				

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 1
(CONTINUED)

Sample					Analysis as mg/l					
					Alkalinity					
1970	Day	Hours	Temp °C	micro- mhos/cm at 25°C	pH	Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
3-17	76	24			7.6					
3-15	74	24			7.1					
3-12	71	24			7.7					
3-11	70	24			7.3					
3-10	69	24			8.1					
3-5	64	24			8.9					
3-3	62	24								
3-2	61	24			6.8					
3-1	60	24			7.0					
2-25	56									
2-23	54									
2-18	49									
2-16	47									
2-12	43									
2-8	39									
2-5	36									
2-3	34									
1-29	29	24			7.0					

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 2

		Analysis as mg/l									
		Phosphate Unfiltered		Phosphate Filtered				Nitrate			
1971	Day	Total	Ortho	Total	Ortho						
		PO ₄	P	PO ₄	P	PO ₄	P	PO ₄	P	NO ₃	N
6-30	181			2.20	0.72	0.55	0.18	8.86	2.00		
6-29	180	1.04	0.37			0.58	0.19	2.66	0.60		
6-28	179	0.55	0.18			0.31	0.10	4.34	0.98		
6-24	175	1.47	0.48			0.83	0.27	7.09	1.60		
6-23	174	1.29	0.42			1.01	0.33	3.28	0.74		
6-22	173	0.73	0.24			0.52	0.17	2.39	0.54		
6-21	172	1.04	0.34			0.72	0.23				
6-17	168	5.66	1.85			5.66	1.85	4.87	1.10		
6-16	167	1.07	0.35			0.70	0.23	3.54	0.80		
6-15	166	1.13	0.37			1.02	0.36	3.19	0.72		
6-14	165	1.22	0.40			1.22	0.40	3.32	0.75		
6-10	161	0.89	0.29			0.73	0.24	7.53	1.70		
6-9	160										
6-8	159	0.55	0.18			0.37	0.12	7.09	1.60		
6-7	158	1.01	0.33			0.70	0.23	7.53	1.70		
6-3	154	1.56	0.51			1.50	0.49	7.53	1.70		
6-2	153	2.36	0.77			2.20	0.72	7.53	1.70		
6-1	152	2.36	0.77			2.17	0.71	7.09	1.60		
5-31	151	4.65	1.52			4.28	1.40	6.65	1.50		
5-27	147	3.98	1.30			2.60	0.85	6.65	1.50		
5-26	146	7.06	2.30			6.73	2.20	5.32	1.20		
5-25	145	4.44	1.45			3.92	1.28	6.20	1.40		
5-24	144	3.52	1.15			2.69	0.88	5.76	1.30		
5-20	140	5.66	1.85			5.66	1.85				
5-19	139	9.18	3.00			8.26	2.70	6.20	1.40		
5-17	137					2.10	1.50	3.77	0.85		
5-13	133	6.73	2.20			6.12	2.00	6.20	1.40		
5-11	131	6.73	2.20			6.12	2.00	6.65	1.50		
5-10	130					3.76	1.23	2.22	0.50		
5-6	126	3.82	1.25			3.82	1.25	7.53	1.70		
5-5	125	3.67	1.20			3.52	1.15	5.32	1.20		
5-4	124	3.46	1.13			3.15	1.05	6.20	1.40		
5-3	123	2.63	0.86			2.51	0.82	6.20	1.40		

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 2
(CONTINUED)

1971	Day	Analysis as mg/l								Nitrate	
		Phosphate Unfiltered				Phosphate Filtered				NO ₃	N
		Total PO ₄	P	Ortho PO ₄	P	Total PO ₄	P	Ortho PO ₄	P		
4-29	119	7.06	2.30					6.73	2.20	7.09	1.60
4-28	118										
4-26	116	6.73	2.20					6.73	2.20	7.53	1.70
4-22	112	3.40	0.17					3.20	0.16	6.65	1.50
4-21	111	6.89	2.25					6.58	2.15	9.75	2.20
4-20	110	7.06	2.30					6.73	2.20	8.42	1.90
4-19	109									6.20	1.40
4-15	105	6.73	2.20					6.73	2.20	8.42	1.90
4-14	104	6.73	2.20					6.73	2.20	4.87	1.10
4-13	103	6.12	2.00					6.12	2.00	7.09	1.60
4-12	102										
4-8	98	2.57	0.84					2.48	0.81	6.10	1.40
4-7	97									6.65	1.50
4-6	96	6.73	2.20					6.73	2.20	6.65	1.50
4-5	95										
3-31	90										
3-30	89	4.13	1.35					3.82	1.25	6.65	1.50
3-29	88										
3-25	84	6.12	2.00					6.12	2.00	10.60	2.40
3-24	83	3.52	1.15							8.42	1.90
3-23	82	6.12	2.00					5.81	1.90	7.09	1.60
3-22	81										
3-18	77	5.81	1.90					3.00	0.98	7.09	1.60
3-17	76	5.97	1.95							7.09	1.60
3-16	75	6.12	2.00					5.81	1.90	8.42	1.90
3-15	74	6.73	2.20							7.53	1.70
3-11	70	3.37	1.10					2.87	0.94	8.86	2.00
3-9	68	6.12	2.00					5.81	1.90	7.53	1.70
3-4	63	4.59	1.50					4.28	1.40	7.53	1.70
3-3	62	4.74	1.55							6.20	1.40
3-2	61	4.90	1.60					4.59	1.50	7.09	1.60
3-1	60	5.81	1.90							5.76	1.30

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 2
(CONTINUED)

Analysis as mg/l											
		Phosphate Unfiltered				Phosphate Filtered				Nitrate	
		Total		Ortho		Total		Ortho			
1971	Day	PO ₄	P	PO ₄	P	PO ₄	P	PO ₄	P	NO ₃	N
2-25	56	2.36	0.77					1.99	0.66	4.87	1.10
2-25	56	1.47	0.48							4.21	0.95
2-23	54	2.04	0.67					2.35	0.77	4.43	1.00
2-22	53	2.35	0.77							3.10	0.70
2-18	49	3.00	0.98					2.87	0.94	17.70	4.00
2-17	48	3.98	1.30					3.67	1.20	3.54	0.80
2-16	47	6.73	2.20					6.73	2.20		
2-15	46										
2-10	41	1.53	0.50							4.43	1.00
2-9	40	4.28	1.40					4.13	1.35	4.87	1.10
2-8	39	3.00	0.98							5.32	1.20
2-4	35	3.06	1.00					0.64	0.21	9.75	2.20
2-3	34	3.06	1.00							7.97	1.80
2-2	33	3.37	1.10					2.51	0.82	6.20	1.40
1-28	28	1.35	0.44					0.77	0.25	4.87	1.10
1-27	27	2.26	0.74							3.63	0.82
1-26	26	6.73	2.20					4.74	1.55	6.73	1.52
1-25	25	2.39	0.78							3.10	0.70
1-14	14	0.73	0.24					0.55	0.18	0.62	0.14
1-13	13	1.22	0.40							3.10	0.70
1-12	12	6.12	2.00					1.22	0.40	3.32	0.75
1-11	11									2.44	0.55
1-7	7	5.05	1.65					2.05	0.67	1.95	0.44
1-6	6	0.15	0.05							2.88	0.65
1-5	5							2.69	0.88	1.95	0.44
1-4	4	5.05	1.65							1.24	0.28
1970											
12-30	364	6.12	2.00							2.75	0.62
12-22	356	11.60	3.20					8.26	2.70	1.46	0.33
12-17	351	2.35	0.77					1.41	0.46	1.02	0.23
12-16	350	3.37	1.10							1.02	0.23
12-15	349	4.53	1.48					2.82	0.92	0.80	0.18
12-14	348	3.21	1.05							0.93	0.21
12-10	344	4.90	1.60					2.57	0.84	3.54	0.80
12-9	343	3.37	1.10							2.04	0.46
12-8	342	1.99	0.65					1.84	0.60	1.42	0.32
12-7	341	5.05	1.65							1.64	0.37

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 2
(CONTINUED)

		Analysis as mg/l									
		Phosphate Unfiltered				Phosphate Filtered				Nitrate	
		Total	Ortho			Total	Ortho				
1970	Day	PO ₄	P	PO ₄	P	PO ₄	P	PO ₄	P	NO ₃	N
11-13	317										
11-5	309							0.92	0.23	1.42	0.32
11-2	306										
10-29	302									1.51	0.34
10-28	301									1.42	0.32
10-27	300	3.06	1.00			3.06	1.00			1.37	0.31
10-26	299	3.10	1.01							1.37	0.31
10-21	294										
10-20	293										
10-15	288	1.90	0.62			1.90	0.62			0.80	0.18
10-12	285										
10-9	282										
9-30	273	3.20	1.06							1.33	0.30
8-27	239	1.20	0.39			0.73	0.24			17.70	4.00
8-26	238	1.30	0.42							19.50	4.40
8-25	237	2.90	0.95			2.90	0.95			23.00	5.20
8-24	236	1.95	0.64							21.30	4.80
8-20	232	0.70	0.23			0.62	0.20				
8-19	232	1.40	0.46							2.13	0.48
8-18	230	1.50	0.49			1.70	0.56			23.00	5.20
8-17	229	2.00	0.65							19.50	4.40
8-13	225	1.10	0.36			1.40	0.46			17.70	4.00
8-12	224	1.60	0.50							14.20	3.20
8-11	223	1.60	0.52	1.60	0.52	1.60	0.52			12.40	2.80
8-10	222	2.70	0.88								
8-6	218	1.80	0.59	2.10	0.69	2.50	0.82				
8-5	217										
8-4	216	3.00	0.98	2.90	0.95	0.37	0.12			17.70	4.00
8-3	215									19.50	4.40

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 2
(CONTINUED)

		Analysis as mg/l									
		Phosphate Unfiltered				Phosphate Filtered				Nitrate	
		Total	Ortho			Total	Ortho				
1970	Day	PO ₄	P	PO ₄	P	PO ₄	P	PO ₄	P	NO ₃	N
7-30	211	2.50	0.82	2.30	0.75			2.50	0.82		
7-28	209	1.40	0.46	1.90	0.62			2.10	0.69	19.50	4.40
7-27	208									17.70	4.00
7-23	204	0.70	0.23	0.65	0.21			0.90	0.29		
7-22	203									23.90	5.40
7-21	202	0.35	0.11	0.25	0.08			0.85	0.28	111.00	25.00
7-20	201									88.60	20.00
7-16	197	0.75	0.25	0.70	0.23			1.00	0.33		
7-15	196										
7-14	195	3.40	1.11	2.20	0.72			2.40	0.78	8.86	2.00
7-13	194										
7-9	190										
7-8	189	1.75	0.57	1.75	0.57			1.50	0.49		
7-7	188										
7-6	187	5.60	1.83					3.00	0.98	66.50	15.00
6-30	181										
6-29	180	3.35	1.09					3.50	1.14		
6-25	176										
6-24	175	1.20	0.39	0.85	0.28			0.80	0.26		
6-23	174										
6-22	173	1.00	0.33					0.50	0.16	1.15	0.26
6-18	169										
6-17	168	8.70	2.84	8.60	2.81			8.00	2.61		
6-11	162										
6-10	160										
6-9	159	3.35	1.09					3.35	1.09	4.43	1.00
6-4	155										
6-3	154	4.60	1.50	3.35	1.09			3.35	1.09		
6-2	153										

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 2
(CONTINUED)

1970	Day	Analysis as mg/l								Nitrate	
		Phosphate Unfiltered				Phosphate Filtered				NO ₃	N
		Total PO ₄	P	Ortho PO ₄	P	Total PO ₄	P	Ortho PO ₄	P		
5-27	147	1.30	0.43	1.05	0.34			0.95	0.31		
5-26	146										
5-25	145	1.60	0.52					1.10	0.36		
5-21	141										
5-20	140	1.45	0.47	1.15	0.38			1.15	0.38		
5-19	139	17.50	5.71					12.0	3.92	39.90	9.00
5-14	134	1.05	0.34					0.85	0.28	39.90	9.00
5-13	133	1.60	0.52	1.40	0.45					28.80	6.50
5-11	131	1.20	0.39	1.25	0.41					31.00	7.00
5-6	126	1.55	0.51	1.45	0.47					111.00	25.00
5-5	125	1.75	0.57	0.95	0.31					66.50	15.00
5-4	124	1.05	0.34	1.00	0.33					8.86	20.00
4-28	118	1.30	0.42	1.30	0.42					57.60	13.00
4-27	117	3.20	1.04	2.85	0.93					51.00	11.50
4-26	116										
4-23	113	1.30	0.42	0.95	0.31					68.70	15.50
4-22	112	1.05	0.34	0.90	0.29					75.30	17.00
4-21	111	2.15	0.70	1.85	0.60					77.50	17.50
3-17	76	3.70	1.21	2.80	0.92					22.20	5.00
3-15	74										
3-12	71	1.10	0.36	0.90	0.29					37.70	8.50
3-11	70	1.50	0.49	1.40	0.48					17.70	4.00
3-10	69	2.30	0.75	2.10	0.69					8.86	2.00
3-5	64	1.50	0.49	1.20	0.39					28.80	6.50
3-3	62	2.10	0.69	1.90	0.62						
3-2	61	1.70	0.56	1.50	0.49						
3-1	60	2.15	0.70	1.45	0.47						
2-25	56	2.30	0.75							35.40	8.00
2-23	54	1.80	0.59							53.20	12.00
2-18	49	2.50	0.82							44.30	10.00
2-16	47	1.10	0.36							66.50	15.00
2-12	43	2.40	0.78							44.30	10.00
2-8	39	1.45	0.47								
2-5	36	0.75	0.25							48.70	11.00
2-3	34	1.75	0.57							37.70	8.50

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 2
(CONTINUED)

Analysis as mg/l											
		Phosphate Unfiltered				Phosphate Filtered				Nitrate	
		Total		Ortho		Total		Ortho			
1970	Day	PO ₄	P	PO ₄	P	PO ₄	P	PO ₄	P	NO ₃	N
1-29	29	1.30	0.42							57.60	13.00

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 3

1971	Day	Analysis as mg/l								
		Nitrite NO ₂	N	Ammonia NH ₄	N	Organic N	Calcium Ca	CaCO ₃	Magnesium Mg	CaCO ₃
6-30	181	0.69	0.21	5.54	4.30	7.80	124.2	310.5	7.8	32.0
6-29	180		0.62		0.85	6.35	121.0	302.5	6.8	27.9
6-28	179	0.79	0.24	8.76	6.80	2.60	122.6	306.5	3.4	13.9
6-24	175		0.18		10.70	1.21	98.6	246.5	10.2	41.8
6-23	174	0.36	0.11	11.30	8.80	10.60	92.9	232.3	13.2	54.1
6-22	173		0.15		7.50	2.50	98.5	246.3	10.7	43.9
6-21	172	0.80	0.26	9.40	7.30	0.52	115.3	288.3	10.7	43.9
6-17	168		0.40		2.45	4.95	118.5	296.3	19.5	80.0
6-16	167	1.22	0.37	8.76	6.80	7.70	97.7	244.3	20.0	82.0
6-15	166		0.94		6.50	5.80	103.3	258.3	18.0	73.8
6-14	165	2.43	0.74	17.40	13.50	0.27	108.1	270.3	12.2	50.0
6-10	161		0.08		0.42	1.07	157.8	394.5	2.4	9.8
6-9	160									
6-8	159	0.23	0.07		0.35	1.51	146.6	366.5	1.0	4.1
6-7	158	0.86	0.26	0.15	0.12	2.47	147.4	368.5	4.9	20.1
6-3	154		0.17		0.22	2.76	144.2	360.5	5.4	22.1
6-2	153	0.13	0.04	0.13	0.10	2.88	141.8	354.5	5.8	23.8
6-1	152	0.13	0.04		0.37	1.49	150.6	376.5	4.4	18.0
5-31	151	0.23	0.07				160.2	400.5	4.4	18.0
5-27	147		0.54		0.42	3.67	120.1	300.3	17.5	71.8
5-26	146	0.99	0.30	3.99	3.10	2.48	103.3	258.3	32.6	134
5-25	145		0.78		0.48	2.87	97.7	244.3	39.0	160
5-24	144	0.14	0.04				99.3	248.3	34.1	140
5-20	140		0.02				109.7	274.3	37.0	152
5-19	139	1.05	0.32				120.9	302.3	33.1	136
5-17	137		0.05				116.1	290.3	33.6	138
5-13	133		0.09		0.10	2.01	116.1	290.3	35.1	144
5-12	132									
5-11	131		0.06		0.05	3.85	109.7	274.3	37.0	152
5-10	130						122.6	306.5	32.1	132
5-6	126		0.16		1.00	2.02	120.1	300.3	35.6	146
5-5	125	0.07	0.02	1.42	1.10	10.40	116.9	292.3	35.6	146
5-4	124		0.00		0.82	0.39	102.5	256.3	41.9	172
5-3	123		0.18				111.3	278.3	35.1	144

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 3
(CONTINUED)

1971	Day	Nitrite		Ammonia		Analysis as mg/l			Magnesium	
		NO ₂	N	NH ₄	N	Organic N	Calcium Ca	CaCO ₃	Mg	CaCO ₃
4-29	119						108.9	272.3	39.0	160
4-28	118									
4-26	116	0.16	0.05		2.55	2.85	111.3	278.3	36.5	150
4-22	112		0.28		3.53	3.67	115.3	288.3	40.4	166
4-21	111		0.66		2.50	4.10	123.4	308.5	39.0	160
4-20	110		0.46		1.40	7.90	111.0	277.5	43.3	178
4-19	109		0.39		1.15	2.15	109.0	272.5	42.9	176
4-15	105		0.40		1.25	9.73	120.1	300.3	33.6	138
4-14	104	1.51	0.46	5.68	4.41	1.37	119.3	298.3	34.6	142
4-13	103		0.25		0.51	5.27	117.7	294.3	36.5	150
4-12	102									
4-8	98		0.36		3.54	0.80	112.9	282.3	38.0	156
4-7	97						110.5	276.3	37.0	152
4-6	96		0.44		6.79	10.81	112.1	280.3	35.6	146
4-5	95									
3-31	90						112.1	280.3	34.6	
3-30	89		0.80		2.70	1.80	109.0	272.5	35.6	146
3-29	88									
3-25	84		0.15		1.58	3.52	127.4	318.5	36.0	148
3-24	83		0.36	1.55	1.20	0.30	127.4	318.5	39.0	160
3-23	82		0.22		0.76	7.64	125.0	312.5	36.0	148
3-22	81									
3-18	77		0.09		1.20	2.10	129.0	322.5	35.1	144
3-17	76	0.43	0.13	0.93	0.72	3.78	124.0	310.0	34.6	142
3-16	75		0.10		0.40	4.40	126.6	316.5	29.7	122
3-15	74	0.39	0.12	2.32	1.80	1.50	120.9	302.3	34.6	142
3-11	70		0.15		3.40	1.40	116.9	292.3	36.0	148
3-9	68		0.10		2.20	1.10	111.3	278.3	37.5	154
3-4	63		0.11		1.35	6.45	136.2	340.5	28.7	118
3-3	62	0.59	0.18	2.83	2.20	6.20	121.6	304.0	35.6	146
3-2	61		0.31		4.10	4.60	129.8	324.5	27.8	114
3-1	60	0.59	0.18	7.08	5.50	2.90	119.3	298.3	37.0	152

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 3
(CONTINUED)

1971	Day	Nitrite		Ammonia		Analysis as mg/l			Magnesium	
		NO ₂	N	NH ₄	N	Organic N	Calcium Ca	CaCO ₃	Mg	CaCO ₃
2-25	56		0.16		4.20	0.40	105.7	264.3	29.7	122
2-25	56		0.15	10.40	8.10	3.60	101.1	252.8	33.1	136
2-23	54		0.16		9.60	3.60	108.9	272.3	28.7	118
2-22	53	0.43	0.13	6.88	5.30	7.30	113.7	284.3	30.7	126
2-18	49		0.15		5.50	3.20	108.1	270.3	26.3	108
2-17	48	0.39	0.12	17.40	13.50	4.30	96.1	240.3	34.6	142
2-16	47		0.12		6.60	8.20				
2-15	46									
2-10	41		0.15		12.00	6.10	100.9	252.3	36.0	
2-9	40		0.17		10.00	7.80	101.7	254.3	27.3	112
2-8	39		0.19		11.40	7.00	92.9	232.3	31.7	130
2-4	35		0.20		6.70	12.30	101.7	254.3	30.2	124
2-3	34		0.27		12.90	6.40	87.3	218.3	35.1	144
2-2	33		0.39		15.60	1.60	103.3	258.3	37.5	154
1-28	28		0.44		12.20	3.20	103.3	258.3	27.8	114
1-27	27		0.14	20.40	15.80	6.50	106.5	266.3	22.4	91.8
1-26	26		0.18		14.20	5.60	121.7	304.3	21.9	89.8
1-25	25		0.17		14.00	5.20	85.7	214.3	33.1	136
1-14	14		0.10		5.80	0.20				
1-13	13		0.22	5.15	4.00	3.20	120.1	300.3	21.9	89.8
1-12	12		0.19		3.68	4.70	149.8	374.5	12.7	52.1
1-11	11		0.15				121.8	304.5	29.2	120
1-7	7		0.84		9.15	5.25	96.9	242.3	34.6	142
1-6	6	1.05	0.32	9.40	7.30	9.50	108.9	272.3	19.0	77.9
1-5	5		0.40		6.75		116.1	290.3	17.5	71.8
1-4	4	0.63	0.19		13.80	3.00	106.5	266.3	25.8	106

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 3
(CONTINUED)

1970	Day	Analysis as mg/l							
		Nitrite NO ₂	N	Ammonia NH ₄	N	Organic N	Calcium Ca	CaCO ₃	Magnesium Mg
									CaCO ₃
12-30	364	0.39	10.10	7.80	11.10	107.3	268.3	39.0	160
12-22	356	0.74		10.20	0.30	110.0	275.0	36.5	150
12-17	351	0.16		11.60	9.70	92.1	230.3	26.3	108
12-16	350	0.10		8.78	15.20	93.7	234.3	30.2	124
12-15	349	0.07		17.60	2.80	90.5	226.3	22.9	93.9
12-14	348	0.25		0.05	1.45				
12-10	344	0.60		8.93	5.17	109.7	274.3	15.1	61.9
12-9	343	0.19		11.90	1.60	97.7	244.3	11.2	45.9
12-8	342	0.70		12.40	0.50	81.7	204.3	24.3	99.6
12-7	341	0.20		10.40	2.50	92.9	232.3	27.8	114
11-13	317	1.15		6.00	9.30	115.3	288.3	22.4	91.8
11-5	309								
11-3	307					124.2	310.5	10.7	43.9
11-2	306					112.1	280.3	15.6	64.0
10-29	302			8.70	3.90	108.1	270.3	17.0	69.7
10-28	301	4.60				110.5	276.3	17.0	69.7
10-27	300	1.30		10.70	1.90	112.1	280.3	14.1	57.8
10-26	299	1.30				126.6	316.5	12.2	50.0
10-21	294					83.3	208.3	18.0	73.8
10-20	293								
10-15	288	0.33		8.70	10.60	80.9	202.3		
10-12	285					77.7	194.3	20.5	84.1
10-9	282					113.0	282.5	9.7	39.8
9-30	273	0.40		3.07	14.10	109.7	274.3	14.1	57.8

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 3
(CONTINUED)

1970	Day	Analysis as mg/l								
		Nitrite NO ₂	N	Ammonia NH ₄	N	Organic N	Calcium Ca	CaCO ₃	Magnesium Mg	CaCO ₃
8-27	239		0.09		1.52	2.13	102.5	256.3		
8-26	238		0.03		0.96	3.30	100.9	252.3	28.7	117.7
8-25	237		0.04		0.50	2.54	109.7	274.3	18.5	75.9
8-24	236		0.20		0.69	3.57	129.0	322.5	11.7	48.0
8-20	232						106.0	265.0		
8-19	231		0.13		12.46	9.12	80.1	200.3	41.9	172
8-18	230						88.9	222.3		
8-17	229		0.07		1.31	2.25	108.1	270.3	15.6	64.0
8-13	225		0.01		0.14	2.90	95.3	238.3		
8-12	224		0.10		0.56	3.09	97.7	244.3	19.5	80.0
8-11	223		0.10		0.73	3.53	96.9	242.3	18.5	75.9
8-10	222		0.16		0.53	7.07	111.3	278.3	20.9	85.7
8-6	218						96.9	242.3	33.6	138
8-5	217									
8-4	216		0.05		0.08	1.44	98.5	246.3	33.6	138
8-3	215		0.16		0.59	0.63	105.0	262.5	36.5	150
7-30	211						102.0	255.0	32.1	132
7-28	209		0.20		1.19	1.55	111.0	277.5	23.4	
7-27	208		0.30		5.55		140.2	350.5	9.7	39.8
7-23	204						96.9	242.3	29.7	122
7-22	203									
7-21	202		0.35		0.91	2.74	102.5	256.3	13.1	53.7
7-20	201		1.15		5.62		116.9	292.3	7.3	29.9
7-16	197		1.25				109.7	274.3	13.6	55.8
7-15	196									
7-14	195				3.34	6.66	101.0	252.5	28.2	116
7-13	194									
7-9	190									
7-8	189						109.7	274.3	13.6	55.8
7-7	188									
7-6	187				6.44		100.9	252.3	34.1	139.8

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 3
(CONTINUED)

1970	Day	Analysis as mg/l								
		Nitrite NO ₂	N	Ammonia NH ₄	N	Organic N	Calcium Ca	Calcium CaCO ₃	Magnesium Mg	CaCO ₃
6-30	181									
6-29	180						123.4	308.5	14.1	57.8
6-25	176									
6-24	175						103.3	258.3	9.2	37.7
6-23	174									
6-22	173				8.36		112.1	280.3	5.4	22.1
6-18	169									
6-17	168						103.0	257.5	23.9	98.0
6-11	162									
6-10	160									
6-9	159				0.56	3.39	131.4	328.5	11.7	48.0
6-4	155									
6-3	154						108.0	270.0	33.1	136
6-2	153									
5-27	147						115.0	287.5	22.9	93.9
5-26	146									
5-25	145				0.91		105.7	264.3	19.0	77.9
5-21	141									
5-20	140						106.0	265.0	15.1	61.9
5-19	139				1.75		94.5	236.3	39.4	162
5-14	134		0.70		1.19					
5-13	133		0.82		0.46	1.36				
5-11	131		0.12		1.67	3.19				
5-6	126		0.50		1.50	2.73				
5-5	125		0.85		1.43	8.60				
5-4	124		0.01		0.54	9.80	103.0	257.5	35.5	146

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 3
(CONTINUED)

1970	Day	Analysis as mg/l								
		Nitrite NO ₂	N	Ammonia NH ₄	N	Organic	Calcium Ca	CaCO ₃	Magnesium Mg	CaCO ₃
4-28	118		0.04		1.49	1.83				
4-27	117		0.50		2.42	2.71				
4-26	116									
4-23	113		0.37		1.21	3.02				
4-22	112		0.23		0.15	0.45				
4-21	111		0.12		2.40	2.40				
4-17	76		0.34		1.51	0.89				
4-15	74									
4-12	71		0.05		1.40	3.00				
4-11	70		0.05		1.60	4.20				
4-10	69		0.04		2.30	2.90				
4-5	64		1.13		1.48	4.02				
4-3	62									
4-2			0.04							
4-1	60									
2-25	56		0.01		0.01	0.87				
2-23	54		0.30		4.50	11.50				
2-18	49		0.01		0.01	8.10				
2-16	47		0.06		0.28	3.22				
2-12	43		0.17		0.90	5.19				
2-8	39									
2-5	36		5.00		0.44	2.65				
2-3	34		0.04		0.51	5.91				
1-29	29		0.16		2.31	4.10				
1-25	25		0.04		0.90	3.50				

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 4

1971	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
6-30	181	342	250	24.0	0.26			6.50	18.7	18.6
6-29	180	330								
6-28	179	320								
6-24	175	288								
6-23	174	286								
6-22	173	290								
6-21	172	332								
6-17	168	376								
6-16	167	326								
6-15	166	332								
6-14	165	320								
6-10	161	404								
6-9	160									
6-8	159	370								
6-7	158	388								
6-3	154	382								
6-2	153	378								
6-1	152	394								
5-31	151	418								
5-27	147	372								
5-26	146	392								
5-25	245	404								
5-24	144	388								
5-20	140	426								
5-19	139	438								
5-17	137	428								
5-13	133	434								
5-12	132									
5-11	131	426								
5-10	130	438								
5-6	126	446								
5-5	125	438								
5-4	124	406								
5-3	123	422								

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 4
(CONTINUED)

1971	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
4-29	119	432								
4-28	118									
4-26	116	428								
4-22	112	454								
4-21	111	468								
4-20	110	454								
4-19	109	448								
4-15	105	438								
4-14	104	440								
4-13	103	444								
4-12	102									
4-8	98	438								
4-7	97	428								
4-6	96	426								
4-5	95									
3-31	90	422								
3-30	89	418								
3-29	88									
3-25	84	466								
3-24	83	478	228		0.23			5.00	20.1	19.9
3-23	82	460								
3-22	81									
3-18	77	466								
3-17	76	452	220	20.0	0.25			20.75	19.2	19.1
3-16	75	438								
3-15	74	444	224	20.8	0.08			21.00	19.3	19.3
3-11	70	440								
3-9	68	432								
3-4	63	458								
3-3	62	450	216	20.4	0.13			12.75	19.1	19.0
3-2	61	438								
3-1	60	450	235	20.0	0.13			18.25		

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 4
(CONTINUED)

1971	Day	Total Hardness as CaCO ₃	Analysis as mg/l					mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation Anion
2-25	56	386							
2-25	56	386	225	18.0	0.08			12.00	18.6 18.5
2-23	54	390							
2-22	53	410	230	19.3	0.05			17.00	
2-18	49	378							
2-17	48	382	235	20.0	0.06			10.50	19.3 19.7
2-16	47								
2-15	46								
2-10	41	400	236	20.0	0.04			18.30	19.6 19.4
2-9	40	366							
2-8	39	362	234	19.3	0.05				18.7 19.0
2-4	35	328							18.7 18.4
2-3	34	362	230	20.0	0.15				
2-2	33	412							
1-28	28	372							
1-27	27	358	240	20.0	0.08				19.2 19.4
1-26	26	394							
1-25	25	350	246	18.0	0.00				18.9 18.3
1-14	14	360							
1-13	13	390	240	19.0	0.06				17.1 16.8
1-12	12	426							
1-11	11	424							
1-7	7	384							
1-6	6	350	230	20.0	0.04			4.40	18.0 17.5
1-5	5	376							
1-4	4	372	240	18.0	0.08			11.10	
<u>1970</u>									
12-30	364	428	250	19.0					20.5 20.6
12-22	356	424							
12-17	351	338							
12-16	350	358						13.90	
12-15	349	320							
12-14	348								
12-10	344	336							
12-9	343	290	256	18.8	0.10				18.1 18.3
12-8	342	304							
12-7	341	346							

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 4
(CONTINUED)

1970	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
11-13	317	380								
11-5	309									
11-3	307	354								
11-2	306	344								
10-29	302	340								
10-28	301	348	210	18.8	0.12					
10-27	300	338								
10-26	299	366	212	18.0	0.10				17.1	16.7
10-21	294									
10-20	293	282	220		0.12					
10-15	288									
10-12	285	278	212		0.28					
10-9	282	322	212		0.70					
9-30	273	332	216	20.0	0.10				17.7	17.7
8-27	239	322								
8-26	238	370	212	18.4	0.10				17.2	17.3
8-25	237	350								
8-24	236	370	212	20.4	0.08				17.2	17.4
8-20	232									
8-19	231	372	216	20.8	0.18				18.3	18.1
8-18	230	314								
8-17	229	334			0.12				16.9	17.1
8-13	225	308								
8-12	224	324	208	20.8	0.10				16.1	16.2
8-11	223	318								
8-10	222	364	216	20.4	0.12				17.2	17.4
8-6	218	380								
8-5	217									
8-4	216	384								
8-3	215	412								

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 4
(CONTINUED)

1970	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
7-30	211	388								
7-28	209	374								
7-27	208	390								
7-23	204	364								
7-22	203									
7-21	202	310								
7-20	201	322								
7-16	197	330								
7-15	196									
7-14	195	368								
7-13	194									
7-9	190									
7-8	189	330								
7-7	188									
7-6	187	392								
6-30	181									
6-29	180	365								
6-25	176									
6-25	175	314								
6-23	174									
6-22	173	302								
6-18	169									
6-17	168	356								
6-11	162									
6-10	160									
6-9	159	376								
6-4	155									
6-3	154	410								
6-2	153									

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 4
(CONTINUED)

1970	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
5-27	147	380								
5-26	146									
5-25	145	342								
5-21	141									
5-20	140	328								
5-19	139	398								
5-14	134									
5-13	133									
5-11	131									
5-6	126									
5-5	125									
5-4	124	404								
4-28	118									
4-27	117									
4-26	116									
4-23	113									
4-22	112									
4-21	111									
3-17	76									
3-15	74									
3-12	71									
3-11	70									
3-10	69									
3-5	64									
3-3	62									
3-2	61									
3-1	60									

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 5

1971	Day	COD		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		as mg/l	Dis- solved				Volatile Suspended Solids	Susp. Solids	Total Dissolved Solids
		Total							
7-15	196	19.5			3.0			24	
7-13	194	22.6		5.2	6.0	10		29	
7-8	189	40.0			2.0			26	
7-6	187	16.1		2.8	3.0	15		30	
7-1	182	24.6		6.8	3.0			35	
6-30	181	20.2	17.1		1.4	25		26	1160
6-29	180	17.6			1.4	15		19	
6-28	179	22.6	20.7		1.4	15		29	1165
6-24	175	29.9		15.6	4.5			24	
6-23	174	25.3	23.9		2.0	20		24	1130
6-22	173	33.1			3.0	20		32	
6-21	172	24.7	23.5		2.3	15		31	1180
6-17	168	16.7			2.5			33	
6-16	167	23.2	21.0		2.0	15		41	1300
6-15	166	26.1		7.6	4.0	20		37	
6-14	165	21.6	17.0		1.8	20		34	1215
6-10	161	25.0			2.0			26	
6-9	160	24.5	24.1		1.3	15		25	1340
6-8	159	21.3		0.4	4.0	15		43	
6-7	158	19.4	16.4		1.4	10		27	1430
6-3	154	27.6			3.0			32	
6-2	153	18.2	17.4		1.7	15		33	1360
6-1	152	21.1	17.7	0.8	1.5	15		27	

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 5
(CONTINUED)

1971	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	Total Dissolved Solids
5-31	151	19.1	18.3		3.5	20		38	1460
5-27	147	24.4			11.0			47	
5-26	146	26.6	22.7		2.3	30		21	1180
5-25	145	17.6			2.0	25		28	
5-24	144	33.5	21.8		1.5	25		35	1335
5-20	140	22.9			2.2			22	
5-19	139	28.5	26.5		1.4	25		24	1435
5-17	137	30.3	12.9		1.5	25		22	1452
5-13	133	23.1			2.0			26	
5-12	132	21.2	20.4		1.1	30		25	1425
5-11	131	26.3		4.4	3.2	25		27	
5-10	130	28.3	26.4		1.8	30		17	1380
5-6	126	25.5			2.0			24	
5-5	125	31.5	31.1		2.0	30		25	1430
5-4	124	31.6			2.0	25		27	
5-3	123	18.0	17.7						
4-28	118	43.0	26.0						1584
4-26	116	27.3	24.5		4.8	30		31	1370
4-22	112	43.3			7.0			37	
4-21	111	37.2	29.0	3.2	3.0	30		29	1420
4-20	110	20.7		0.8	2.0	35		21	
4-19	109	25.6	24.7		2.7	35		30	1480
4-15	105	39.6			2.5			18	
4-14	104	33.6	28.7		3.3	35		27	1360
4-13	103	22.4		2.4	2.5	40		31	
4-12	102	31.2	30.0		3.3	40		26	1420
4-8	98	27.7			2.7			16	
4-7	97	25.3	24.4		1.7	20		30	1310
4-6	96	27.8		3.6	2.0	25		17	
4-5	95	29.0	25.6		3.2	35		23	1370

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 5
(CONTINUED)

1971	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	Total Dissolved Solids
3-31	90	37.8	35.7		1.0	30		18	1340
3-30	89	31.3		14.0	2.0	30		30	
3-29	88	28.0	27.2		2.8	20		21	1485
3-25	84	28.1			1.8	30		30	
3-24	83	26.6	22.9		2.2	45			1450
3-23	82	35.7		8.0	2.0	30		20	
3-22	81	36.9	33.0		2.7	30		14	1385
3-17	76	28.2	25.9	2.8	2.0	30			1505
3-16	75	33.1			2.0	25		30	
3-15	74	25.8	24.3		2.0	20			1390
3-11	70	37.1			7.0			15	
3-9	68	31.6		12.0	3.0	30		10	
3-4	63	42.6						8	
3-3	62	44.8	39.2	12.4	6.4	30			1340
3-2	61	34.5		18.4	3.5	40		12	
3-1	60	37.5	34.3		3.8	30			1415
2-25	56	34.3			4.2			24	
2-25	56	34.6	31.4	22.8	2.5	20		13	
2-22	53	34.1	26.1		4.4	30			1365
2-18	49	31.5			2.0			29	
2-17	48	48.6	37.6	9.6	3.5	20			1215
2-16	47	32.0		8.0	6.0	30		15	
2-15	46	44.9	44.2						1275
2-10	41	42.7	36.1		5.7	40			1315
2-9	40	35.8			3.0	25		20	
2-8	39	31.6	27.9		5.8	20			1095
2-4	35	28.4			0.8			38	
2-3	34	38.9	34.7	2.0	13.0	30			1160
2-2	33	52.9		12.0	5.0	20		79	

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 5
(CONTINUED)

1971	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	Total Dissolved Solids
1-28	28	33.6			2.0			25	
1-27	27	39.4	37.2	11.0	2.0	25			1300
1-26	26		63.5	14.0		20		70	
1-25	25	56.5	46.6	9.4	4.0	40			1295
1-14	14	39.6			3.0			22	
1-13	13	37.9	37.5		2.7	25			1220
1-12	12	31.6		3.3	1.5	20		22	
1-11	11	35.9	35.8		3.6	20	17	25	
1-7	7	36.0			10.0			18	
1-6	6	37.3	36.3		2.2	15			
1-5	5	49.5		2.7	3.4	20		27	
1-4	4	55.2	47.1		3.7	25			1340
<u>1970</u>									
12-30	364	46.1							1355
12-22	356	40.0			7.0	35		39	
12-17	351	40.8			3.0			12	
12-16	350	42.2	41.5		6.0	45	32	37	1230
12-15	349	49.3		7.2	6.0	45		45	
12-14	348	30.8	29.7		8.0		36	52	
12-10	344	37.3			5.0			99	
12-9	343	38.1	32.6		5.0	25			1135
12-8	342	32.2		5.2	3.5	30		24	
12-7	341	37.3	34.6		3.5	30	34	70	1365
11-13	317	25.8							
11-5	309	31.4	31.0		0.8	20	18	27	1215
11-4	308	26.9		7.9	0.6				
11-1	306	26.2	24.3		2.2	20	18	30	1250

TABLE D-1 CARBON ADSORPTION INFLUENT COMPOSITE SAMPLES, PART 5
(CONTINUED)

1970	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	Total Dissolved Solids
10-29	302	28.8			1.4			14	
10-28	301	31.7	30.9		3.6		13	27	1130
10-27	300	34.9		6.4	3.1	20		12	
10-26	299	28.0	27.6		2.1	25			1230
10-21	294	45.9	43.5						
10-20	293	28.4	27.7		1.1		10	33	1145
10-19	292	33.5	33.5						
10-16	289	37.9	37.5	7.9	1.0	30		17	
10-15	288	42.8	36.0						
10-12	285	46.9	40.8		5.0		21	44	1175
10-9	282	42.3	39.6		8.0		44	50	
10-5	278	63.0	56.2						1105
9-30	273	28.8	24.5		1.7				1205
8-27	239	15.6		0.8	0.6	20		6	
8-26	238	21.2	18.9		0.3	15			1160
8-25	237	19.2			0.6	15		8	
8-24	236	20.8	20.8		0.7	20			1200
8-20	232	27.8						10	
8-19	231	59.8	55.0		6.5	35			1160
8-18	230	32.3			1.6	25		7	
8-17	229	18.3	18.3		0.7	25			1185
8-13	225	27.7			0.9	20		8	
8-12	224	26.7	26.5		0.8	20			1190
8-11	223	23.4						7	
8-10	222	36.7	29.2		1.0	25			1200
8-6	218	35.8			7.0	25		10	
8-5	217	23.1	21.6		1.7	40		5	
8-4	216	27.1			3.0				
8-3	215	27.5	22.9		0.9				

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 5
(CONTINUED)

1970	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		Total	Dis- solved				Volatiles Suspended Solids	Susp. Solids	Total Dissolved Solids
7-30	211	22.7			1.5	35		11	
7-28	209	25.4		3.0	1.5			6	
7-27	208	25.7	24.8		0.9				
7-23	204	25.9			1.5	15		14	
7-22	203	23.7	20.4		0.5	25			
7-21	202	31.3			1.0			12	
7-20	201	32.7	30.6		1.2				
7-16	197	53.2			0.9	20		8	
7-15	196	37.0	36.0		1.3	20			
7-14	195	36.8			0.9			22	
7-13	194	30.7	30.0		1.1				
7-9	190	18.0	18.0		0.7	20			
7-8	189	28.2			1.4			28	
7-7	188	28.7	25.3		0.9				
6-30	181	39.2	36.0		0.8				
6-25	176	50.6	47.6		0.7				
6-23	174	57.8	51.9		0.8				
6-18	169	53.2	50.1		0.8	25			
6-17	168				1.0	25		8	
6-16	167								
6-11	162	37.6	27.6		0.5	15			
6-9	160	30.2	26.8		0.6				
6-4	155	47.9	26.0		1.0	10			
6-3	154				1.6	5		18	
6-2	153	21.6	18.6		1.0				
5-27	147				1.0	27		25	
5-26	146	26.3	25.2		0.5				
5-21	141	27.3	27.1		0.4	20			
5-20	140				0.6	20		10	
5-19	139	29.3	27.8		1.0			8	
5-14	134				0.6				
5-13	133				0.6				
5-11	131				0.6				
5-10	130								
5-6	126	34.8			1.2				
5-5	125				2.2				
5-4	124				1.5				
5-3	123								

TABLE D-1 CARBON ADSORPTION INFLUENT, COMPOSITE SAMPLES, PART 5
(CONTINUED)

1970	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	Total Dissolved Solids
4-28	118				1.0				
4-27	117				0.8				
4-26	116								
4-23	113				0.7				
4-22	112				0.4				
4-19	109								
4-16	106								
3-18	77	11.8	10.5		0.6				
3-15	74	24.7	22.2		0.6				
3-12	71	22.4	12.2		0.5				
3-11	70				1.4				
3-10	69	20.0	20.0		1.0				
3-5	64	40.7	37.0		1.6				
3-4	63								
3-2	61								
3-1	60	16.3	15.2		0.9				
2-25	56	13.5							
2-23	54	18.6							
2-18	49	60.2			0.4				
2-16	47	22.9			9.2				
2-12	43	22.6			1.5				
2-9	40	38.1			4.9				
2-5	36	30.0							
2-3	34	24.8							
1-29	29	30.0							
1-25	25	27.0							

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE SAMPLES, PART 1

1971	Sample Day Hours		Temp °C		micro- mhos/cm at 25°C	pH	Analysis as mg/l Alkalinity				
							Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
6-30	181	24	20.5	1679	7.6	111.6	136.2			254.3	435
6-28	179	24	20.0	1650	7.8	139.5	170.2				
6-23	174	24	21.0	1663	8.8	124.8	152.3	20.2			
6-21	172	24	23.0	1695	7.9	169.4	206.7				
6-16	167	24	13.0	1664	8.5	154.5	188.5	8.6			
6-14	165	24			8.2	182.4	222.5				
6-9	160	24	19.0	1740	8.1						
6-7	158	24	19.0	1752	7.9	148.2	180.8				
6-2	153	24	21.1	1717	7.7	135.2	164.9				
5-31	151	24	16.0	1776	8.3	170.9	208.5	5.8			
5-26	146	24	13.0	1741	7.8	171.0	208.6				
5-24	144	24	23.0	1747	7.6	138.5	169.0				
5-19	139	24	23.0	1789	7.7	203.0	247.7				
5-17	137	19	17.0	1770	7.7	180.6	220.3				
5-12	132	24	22.0	1802	8.1						
5-10	130	24	19.0	1785	8.0						
5-5	125	24	20.0	1815	7.6	177.9	217.0				
5-3	123	24	18.0	1771	8.0	190.7	232.7				
4-28	118	24	18.0	1760	7.3						
4-26	116	24	22.0	1776	8.0	258.0	290.4				
4-21	111	24	23.0	1789	8.0	203.0	247.7				
4-19	109	24	21.0	1804	7.5	180.0	219.6				
4-14	104	24	20.0	1705	8.0	170.4	207.9				
4-12	102	24	20.0	1788	8.3	183.6	224.0	2.2			
4-7	97	24	23.0	1799	7.5	139.2	169.8				
4-5	95	24	20.0	1782	7.5	145.2	177.1				
3-31	90	24	13.0	1765	7.3	162.8	198.6				
3-29	88	14	23.0	1768	7.8	233.0	284.3				
3-24	83	24	23.0	1820	7.8	205.2	250.3			252.3	455
3-22	81	24	22.0	1802	7.5	225.1	274.6				
3-17	76	24	18.0	1806	7.3	196.0	239.1			258.2	370
3-15	74	24	20.0	1749	7.7	205.2	250.3			257.2	370
3-3	62	24	24.0	1734	7.6	210.5	256.8			245.5	380
3-1	60	24	21.0	1782	7.3	226.4	276.2			257.2	340

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 1 (CONTINUED)

1971	Sample		Temp °C	micro- mhos/cm at 25°C	pH	Analysis as mg/l Alkalinity				
	Day	Hours				Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
2-25	56		18.0	1656	7.4	218.5	266.6		251.4	330
2-22	53	24	21.0	1804	7.6	239.6	292.3		255.4	350
2-17	48	24	14.0	1739	7.8	283.0	345.3		240.0	370
2-15	46	24			8.3	277.7	338.8	4.6		
2-10	41	14	20.0	1570	8.8	177.5	216.6	29.4	267.2	360
2-8	39	24	16.0	1420	8.8	187.0	228.1	17.8	253.0	360
2-3	34	13	20.0	1460	9.9	94.3	115.1	54.2	270.0	390
1-27	27	17	13.0	1330	9.3	157.1	191.7	37.3	264.0	370
1-25	25	24	19.0	1420	9.4				260.0	370
1-13	13	19	16.0	1430	8.1	152.8	186.4		250.0	360
1-11	11	24	21.0	1520	8.7	208.0	253.8			
<u>1970</u>										
11-2	306	24	17.0	1360	7.2					
10-28	301	24	17.0	1480	7.1				229.7	306
10-26	299	24		1520	7.1				227.0	310
10-21	294		24.0	1630						
10-20	293		25.0	1620	7.6				228.0	385
10-12	285	24	26.0	1600	7.5				216.0	300
10-9	282		22.0	1660	7.3				239.0	340
10-5	278		24.0	1530						
9-30	273		20.0	1460	7.7				226.0	460
8-26	238	24	18.0	1330	7.4				215.9	385
8-24	236	24	22.0	1500	7.3				224.0	385
8-19	231	24	20.0	1480	7.4				223.0	360
8-17	229	24	21.0	1440	7.5				238.0	375
8-12	224	24	20.0	1400	6.9				236.0	386
8-10	222	24	18.0	1380	7.0				247.0	380
8-5	217									
8-3	215	24								

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 1 (CONTINUED)

1970	Sample		Temp °C	micro- mhos/cm at 25°C	pH	Analysis as mg/l Alkalinity				
	Day	Hours				Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
7-27	208	24								
7-22	203	24								
7-20	201	24								
7-15	196	24								
7-9	190									
6-25	176									
6-18	169									
6-11	162									
6-4	155	24								
5-21	141									
5-10	130				7.5					
5-6	126				7.1					
5-3	123				8.1					
4-26	116				7.3					
4-19	109				7.2	105.0	128			
4-16	106				7.1	108.0	132			
3-12	71				7.7					
3-5	64				9.1					

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 2

		Analysis as mg/l									
		Phosphate Unfiltered				Phosphate Filtered				Nitrate	
		Total	Ortho			Total	Ortho				
1971	Day	PO ₄	P	PO ₄	P	PO ₄	P	PO ₄	P	NO ₃	N
6-30	181					1.13	0.37	0.89	0.29	4.87	1.10
6-28	179	0.52	0.17					0.46	0.15	3.63	0.82
6-23	174	1.19	0.39					0.80	0.26	1.95	0.44
6-21	172	0.95	0.31					0.70	0.23		
6-16	167	1.13	0.37					0.86	0.28	2.79	0.63
6-14	165	1.16	0.38					1.16	0.38	2.22	0.50
6-9	160										
6-7	158	1.01	0.33					0.83	0.27	7.09	1.60
6-2	153	2.36	0.77					2.20	0.72	3.32	0.75
5-31	151	5.63	1.84					3.79	1.24	6.65	1.50
5-26	146	7.04	2.30					6.73	2.20	4.87	1.10
5-24	144	3.58	1.17					2.82	0.92	6.20	1.40
5-19	139	9.18	3.00					8.26	2.70	6.20	1.40
5-17	137							6.43	2.10	6.64	1.50
5-12	132										
5-10	130			3.76	1.23					4.87	1.10
5-5	125	4.13	1.35					3.67	1.20	6.64	1.50
5-3	123	2.33	0.76					2.33	0.76	6.20	1.40
4-28	118										
4-26	116	6.73	2.20					6.73	2.20	5.76	1.30
4-21	111	6.58	2.15					6.58	2.15	8.86	2.00
4-19	109									8.86	2.00
4-14	104	6.73	2.20					6.73	2.20	7.97	1.80
4-12	102										
4-7	97									9.75	2.20
4-5	95										
3-31	90										
3-29	88										
3-24	83	3.52	1.15							8.42	1.90
3-22	81										
3-17	76	5.66	1.85							8.86	2.00
3-15	74	6.73	2.20							8.42	1.90
3-3	62	5.51	1.80							8.42	1.90
3-1	60	4.59	1.50							7.53	1.70

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 2 (CONTINUED)

Analysis as mg/l											
		Phosphate Unfiltered				Phosphate Filtered				Nitrate	
		Total		Ortho		Total		Ortho			
1971	Day	PO ₄	P	PO ₄	P	PO ₄	P	PO ₄	P	NO ₃	N
2-25	56	1.35	0.44								
2-22	53	2.26	0.74							5.32	1.20
2-17	48	4.68	1.53							4.43	1.00
2-15	46							4.59	1.50	3.77	0.85
2-10	41	1.19	0.39								
2-8	39	4.44	1.45							5.54	1.25
2-3	34	0.67	0.22							5.32	1.20
										7.97	1.80
1-27	27	1.16	0.38								
1-25	25	0.86	0.28							3.90	0.88
1-13	13	1.71	0.56							4.21	0.95
1-11	11									3.77	0.85
										2.92	0.66
<u>1970</u>											
11-2	306										
10-28	301										
10-26	299	3.10	1.01							1.51	0.34
10-21	294									1.37	0.31
10-20	293										
10-12	285										
10-9	282										
10-5	278										
9-30	273	5.00	1.63							2.22	0.50
8-26	238	1.90	0.62								
8-24	236	1.75	0.57							19.49	4.40
8-19	231	1.40	0.46							23.04	5.20
8-17	229	1.90	0.62							2.22	0.50
8-12	224	1.60	0.52							19.49	4.40
8-10	222	2.55	0.83							17.72	4.00
8-5	217									17.72	4.00
8-3	215									19.49	4.40

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 2 (CONTINUED)

1970	Day	Analysis as mg/l								Nitrate	
		Phosphate Unfiltered				Phosphate Filtered					
		Total	Ortho	Total	Ortho	Total	Ortho	Total	Ortho	NO ₃	N
		PO ₄	P	PO ₄	P	PO ₄	P	PO ₄	P		
7-27	208									17.72	4.00
7-22	203										
7-20	201									66.45	15.00
7-15	196										
7-9	190										
6-25	176										
6-18	169										
6-11	162										
6-4	155										
5-21	141										
5-10	130										
5-6	126										
5-3	123										
4-26	116										
4-19	109										
4-16	106										
3-12	71										
3-5	64										

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 3

1971	Day	Analysis as mg/l								
		Nitrite NO ₂	N	Ammonia NH ₄	N	Organic N	Calcium Ca	Calcium CaCO ₃	Magnesium Mg	Magnesium CaCO ₃
6-30	181	1.02	0.31	5.30	6.83	7.10	119.3	298	5.8	23.8
6-28	179	1.12	0.34	8.00	10.30	1.80	115.3	288	5.4	22.1
6-23	174	1.41	0.43	6.90	8.90	6.90	104.1	260	10.7	43.9
6-21	172	0.79	0.24	7.80	10.05	2.62	116.9	292	8.8	36.1
6-16	167	1.91	0.58	9.00	11.59	5.90	99.3	248	18.0	73.8
6-14	165	1.58	0.48	8.7	11.20	0.86	109.7	274	10.2	41.8
6-9	160									
6-7	158	0.76	0.23	0.20	0.25	1.67	150.6	376	6.3	25.8
6-2	153	0.03	0.01	0.12	0.15	1.38	142.6	356	6.3	25.8
5-31	151	0.20	0.06				163.4	408	4.9	20.1
5-26	146	0.66	0.20	2.75	3.54	2.46	103.3	258	33.1	136
5-24	144	0.36	0.11				99.3	248	33.6	138
5-19	139	1.12	0.34				120.2	300	33.6	138
5-17	137	0.43	0.13				118.5	296	31.2	128
5-12	132									
5-10	130						123.4	308	31.7	130
5-5	125	0.33	0.10	1.60	2.06	7.50	116.9	292	35.6	146
5-3	123	0.33	0.10				110.5	276	35.1	144
4-28	118									
4-26	116	0.30	0.09	3.50	4.51	3.40	114.5	286	36.0	148
4-21	111	1.22	0.37	2.50	3.22	2.60			38.5	158
4-19	109	0.95	0.29	1.35	1.74	2.85	97.7	244	51.6	212
4-14	104	1.18	0.36	1.52	1.96	1.66	121.0	302	35.6	146
4-12	102									
4-7	97									
4-5	95						110.5	276	37.0	152
3-31	90						112.1	280	36.0	148
3-29	88									
3-24	83	0.99	0.30	0.48	0.62	1.32	132.2	330	36.0	148
3-22	81									
3-17	76	1.61	0.49	0.20	0.26	3.40	126.6	316	34.1	140
3-15	74	1.41	0.43	1.35	1.74	1.65	117.7	290	37.5	154
3-3	62	0.79	0.24	2.05	2.64	2.45	122.6	306	35.6	146
3-1	60	0.53	0.16	5.00	6.44	1.30	118.6	296	35.1	144

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 3 (CONTINUED)

1971	Day	Analysis as mg/l									
		Nitrite		Ammonia		Organic		Calcium		Magnesium	
		NO ₂	N	NH ₄	N	N	Ca	CaCO ₃	Mg	CaCO ₃	
2-25	56	0.69	0.21	3.70	4.80	3.10	101.7	254	34.6	142	
2-22	53	0.49	0.15	6.70	8.63	4.40	113.7	284	31.2	128	
2-17	48	0.39	0.12	8.50	11.60	5.00	96.9	242	38.5	158	
2-15	46										
2-10	41	0.76	0.23	16.20	20.87	3.40	94.5	236	37.0	152	
2-8	39	0.86	0.26	7.60	9.79	2.30	94.5	236	3.5	143	
2-3	34	1.18	0.36	12.50	16.10	0.70	93.7	234	31.2	128	
1-27	27	9.49	0.15	14.60	18.80	0.40	108.1	270	24.8	102	
1-25	25	0.66	0.20	11.50	14.81	5.60	96.1	240	30.2	124	
1-13	13	1.12	0.34	2.50	3.22	0.50	128.2	320	20.0	82.0	
1-11	11	0.82	0.25				112.1	280	27.3	112	
1970											
11-2	306						116.9	292	14.6	59.9	
10-28	301	11.51	3.50				116.1	290	14.6	59.9	
10-26	299	2.80	0.85				119.3	298	12.2	50.0	
10-21	294										
10-20	293						33.3	208	18.0	73.8	
10-12	285						93.7	234	13.2	54.1	
10-9	282						93.7	234	26.8	110	
10-5	278										
9-30	273	0.92	0.28	8.78	11.31	17.92	108.1	270	20.0	82.0	
8-26	238	0.10	0.03	0.63	0.81	2.71	103.3	258	19.0	77.9	
8-24	236	0.43	0.13	0.38	0.49	2.66	130.6	327	9.7	39.8	
8-19	231	0.26	0.08	9.04	11.64	9.81	76.1	190	34.6	142	
8-17	229	0.03	0.01	1.00	1.29	1.74	110.5	276	10.2	41.8	
8-15	224	0.16	0.05	0.19	0.24	3.15	97.7	244	19.5	80.0	
8-10	222	0.43	0.13	0.20	0.26	3.45	109.7	274	22.9	93.9	
8-5	217										
8-3	215	0.69	0.21	0.96	1.24	1.47	98.5	246			

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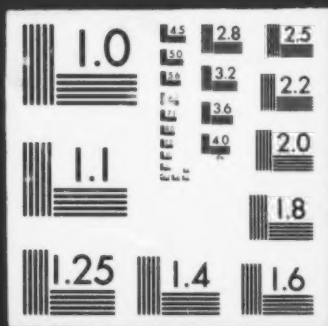


TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 3 (CONTINUED)

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TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 4

1971	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
6-30	181	322	220	23.6	0.26			4.25	17.0	17.3
6-28	179	310								
6-23	174	304								
6-21	172	328								
6-16	167	322								
6-14	165	316								
6-9	160									
6-7	158	402								
6-2	153	382								
5-31	151	428								
5-26	146	394								
5-24	144	386								
5-19	139	438								
5-17	137	424								
5-12	132									
5-10	130	438								
5-5	125	438								
5-3	123	420								
4-28	118									
4-26	116	434								
4-21	111	470								
4-19	109	456								
4-14	104	448								
4-12	102									
4-7	97	428								
4-5	95									
3-31	90	428								
3-29	88									
3-24	83	478								
3-22	81									
3-17	76	456	220	20.4	0.25			18.00	19.4	19.2
3-15	74	444								
3-3	62	450								
3-1	60	450								
			235	18.7	0.13			22.25	20.1	19.7

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 4 (CONTINUED)

1971	Day	Total Hardness as CaCO ₃	Analysis as mg/l					mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation Anion
2-25	56	396	220	18.0	0.08			11.50	18.2 18.0
2-22	53	412	230	19.3	0.05			18.50	19.2 19.1
2-17	48	400	235	20.0	0.06			11.50	19.2 19.5
2-15	46								
2-10	41	388	236	20.0	0.04			18.0	19.7 19.4
2-8	39	378	234	19.3	0.05				18.8 18.7
2-3	34	362	235	21.0					18.9 19.2
1-27	27	372	246	20.0	0.08				19.7 19.3
1-25	25	376	240	16.5	0.00				18.9 18.6
1-13	13	402	240	19.0	0.06				17.4 17.2
1-11	11	392							
<u>1970</u>									
11-2	306	352							
10-28	301	352	210	18.8	0.12				
10-26	299	348	212	18.0	0.10				16.6 16.3
10-21	294								
10-20	293		220		0.12				
10-12	285	288	204		0.28				
10-9	282	344	200		0.70				
10-5	278								
9-30	273	352	216	18.4	0.10				17.7 17.6
8-26	238	334	212	18.4	0.10				16.5 16.6
8-24	236	366	212	18.8	0.08				17.1 17.3
8-19	231	332	232	20.4	0.18				17.9 17.8
8-17	229	314	216	20.4	0.12				16.3 16.6
8-12	224	324	208	20.0	0.10				16.1 16.3
8-10	222	368	216	20.4	0.12				17.3 17.5
8-5	217								
8-3	215	390							

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 4 (CONTINUED)

1970	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
7-27	208									
7-22	203									
7-20	201									
7-15	196									
7-9	190									
6-25	176									
6-18	169									
6-11	162									
6-4	155									
5-21	141									
5-10	130									
5-6	126									
5-3	123									
4-26	116									
4-19	109									
4-16	106									
3-12	71									
3-5	64									

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 5

1971	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		Total Dissolved Solids
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	
6-30	181	22.3	19.5		8.3	25		32	1120
6-28	179	18.2	17.8		1.5	10		28	1130
6-23	174	21.5	20.9		2.5	20		17	1215
6-21	172	21.8	16.9		1.7	5		30	1225
6-16	167	21.3	21.0		3.2	15		35	1290
6-14	165	18.1	16.6		2.5	15		32	1265
6-9	160	20.8	18.0		1.3	10		16	1305
6-7	158	13.0	9.9		1.7	5		21	1370
6-2	153	17.4	14.1		2.0	5		26	1370
5-31	151	18.3	18.0		4.5	15		30	1390
5-26	146	22.7	21.6		2.1	25		24	1160
5-24	144	24.2	22.6		1.0	15		39	1345
5-19	139	22.6	19.8		2.4	20		28	1420
5-17	137	29.9	12.5		1.1	20		21	1452
5-12	132	18.0	16.8		1.4	20		21	1430
5-10	130	28.3	23.9		2.3	20		16	1390
5-5	125	27.0	26.6		2.0	15		15	1400
5-3	123	15.7	14.3						
4-28	118	26.8	21.3						1400
4-26	116	19.7	17.8		2.5	20		22	1350
4-21	111	26.2	18.4	3.2	2.5	20		24	1405
4-19	109	22.0	21.0		2.5	25		16	1420
4-14	104	24.9	24.5		3.1	20		27	1335
4-12	102	26.4	25.6		3.5	40		22	1340
4-7	97	20.4	19.6		1.8	15		9	1310
4-5	95	28.7	21.9		2.8	20		23	1320
3-31	90	40.4	32.3		1.0	20		20	1305
3-29	88	21.4	18.5		2.4	15		19	1445
3-24	83	27.4	20.7		2.5	30			1440
3-22	81	27.2	24.8					19	1390
3-17	76	24.3	22.0	2.0	2.0	15			1505
3-15	74	23.6	22.4		2.0	10			1380
3-3	62	36.1	32.6	8.0	4.5	10			1300
3-1	60	28.9	27.8		2.1	15			1410

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE SAMPLES, PART 5 (CONTINUED)

1971	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		Total Dissolved Solids
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	
2-25	56	30.5	26.5	18.8	1.8	15			1310
2-22	53	24.6	22.4		2.2	15			1285
2-17	48	33.7	30.2		1.9	10			1270
2-15	46	30.2	29.5						1235
2-10	41	26.7	22.7		4.9	15			1510
2-8	39	25.7	21.0		1.2	5			1125
2-3	34	25.4	24.5		1.8	15			1280
1-27	27	21.4	19.8		2.0	10			1255
1-25	25	103.5	22.0		2.6	10			1740
1-13	13	13.8	9.8		1.7	5			1245
1-11	11	20.6	13.9		2.7	5	19	28	
<u>1970</u>									
11-1	306	18.7	15.3		0.7	15	11	24	1230
10-28	301	25.0	25.0		1.9		12	24	1115
10-26	299	21.0	19.8		1.1	1.5			1205
10-21	294	34.1	33.3						
10-20	293	24.4	22.9		2.7		17	31	1120
10-19	292	22.5	22.1						
10-15	283	26.0	23.6						
10-12	285	30.2	27.3		6.0		22	52	1170
10-9	282	25.5	24.8		6.0		16	27	1145
10-5	278	41.7	34.5						1080
9-30	273	18.9	18.1		3.8	20			1170
8-26	238	17.3	16.2		0.3	10			1170
8-24	236	18.9	16.2		0.5	15			1190
8-19	231	36.5	31.8		6.5	15			1100
8-17	229	16.1	15.9		0.4	10			1105
8-12	224	22.1	20.1		0.4	10			1170
8-10	222	27.0	25.4		0.4	15			1200
8-5	217	23.9	23.4			30			
8-3	215	19.0	18.9						

TABLE D-2 CARBON ADSORPTION FIRST COLUMN EFFLUENT, COMPOSITE
SAMPLES, PART 5 (CONTINUED)

1970	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	Total Dissolved Solids
7-27	208	19.8	12.3						
7-22	203	19.2	18.4			20			
7-20	201	24.6	22.5						
7-15	196	28.4	27.2			10			
7-13	194	22.6	22.4						
7-9	190	15.4	13.0			10			
7-7	188	21.7	18.6						
6-30	181	28.9	24.9						
6-25	176	37.3	33.3			15			
6-23	174	39.5	37.5						
6-18	169	41.5	38.0			15			
6-16	167	19.7	19.7						
6-11	162	21.4	18.3			10			
6-9	160	22.7	21.3						
6-4	155	23.2	21.9			10			
6-2	153	14.1	9.9						
5-26	146	18.5	16.8						
5-21	141	18.3	18.1			10			
5-19	139	20.8	19.9						
5-10	130	18.6	17.6	0.7					
5-6	126	21.7	21.2						
5-3	123	8.8	2.4	3.0					
4-26	116	5.4	0.9	0.5					
4-24	112	55.6	51.0	1.4					
4-19	109	12.3	9.5	0.7					
4-16	106	68.0	53.3	1.0					

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 1

analysis as mg/l

analysis as mg/l										
1971	Day	Hours	Temp	micro-	pH	Total	Alkalinity			
			°C	mhos/cm			as CaCO ₂	HCO ₃	CO ₃	Cl
			at 25°C							
6-30	181	18	20.5	1679	8.3	101.7	127.1	6.8	258.2	435
28	179	24	20.0	1650	8.2	177.2	216.2		263.1	415
23	174	24	21.0	1598	8.3	127.1	155.1	1.0	259.2	405
21	172	24	23.0	1664	7.9	174.3	212.7		253.3	415
16	167	24	13.0	1670	8.1	161.3	196.8		254.3	360
14	165	24			7.8	175.9	214.6		265.0	350
9	160	24	20.0	1738	8.3	159.6	194.7	1.9	275.8	370
7	158	24	18.0	1748	8.0	148.2	180.8		261.2	380
2	153	24	21.0	1717	8.1	154.8	188.9		250.5	415
5-31	151	24	16.0	1752	8.3	158.0	192.8	1.9	260.0	415
26	146	24	12.0	1729	7.6	169.4	206.7		252.0	390
24	144	24	23.0	1747	7.7	149.9	182.9		248.0	380
19	139	24	23.0	1789	7.9	212.2	258.9		255.4	380
17	137	19	16.0	1776	7.5	177.9	217.0		257.3	400
12	132	24	22.0	1813	7.9	204.3	249.3		254.4	425
10	130	24	25.0	1710	7.9				252.5	350
5	125	24	20.0	1815	7.9	168.7	205.8		257.3	415
3	123	24	18.0	1760	7.3	173.4	211.6		261.0	350
4-28	118	24	18.0	1771	7.6					
26	116	24	22.0	1781	7.4	252.9	308.5		255.4	450
21	111	24	23.0	1820	7.9	200.0	244.0			
19	109	14	20.0	1837	7.4	196.0	239.1			
14	104	24	19.0	1718	8.1	169.2	206.4		253.4	425
12	102	24	22.0	1738	7.6	154.8	188.9		264.2	360
5	95	24	22.0	1776	7.8	148.8	181.5		266.2	490
3-31	90	24	12.0	1766	7.8	165.5	201.9			
29	88	17	21.0	1771	7.9	233.0	284.3		262.1	440
24	83	24	23.0	1830	7.9	214.5	261.7		250.4	425
22	81	24	23.0	1820	7.9	252.9	308.5		257.2	400
17	76	24	18.0	1811	7.1	196.0	239.1		259.2	370
15	74	24	20.0	1727	7.6	197.3	240.7		255.3	370
3	62	24	24.0	1724	7.5	201.2	245.5		247.4	390
1	60	24	20.0	1804	7.2	219.8	268.2		256.2	380

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 1 (CONTINUED)
analysis as mg/l

1971	Day	Hours	Temp °C	micro- mhos/cm at 25°C	pH	Total as CaCO ₂	Alkalinity			SO ₄
							HCO ₃	CO ₃	Cl	
2-25	56	Grab	18.0	1656	7.5	221.1	269.7		251.4	320
22	53	24	21.0	1674	7.7	247.6	302.1		252.4	350
17	48	24	14.0	1789	8.2	315.0	384.3		239.6	360
15	46	24			8.2	284.5	347.1			
10	41	24				199.3	243.2		266.2	370
8	39	24				176.4	174.3	20.1	251.0	390
3	34	13				98.6	40.0	39.5	267.0	380
1-27	27	17	13.0	1690	9.1	144.2	119.0	28.0	261.0	370
25	25	24	19.0	2441	9.0	161.9	136.6	29.9		
19	19									
13	13	19	15.0	1747	8.0	151.5	184.8		250.0	360
11	11	24	21.0	1674	8.2	158.0	192.8			
6	6	Grab				135.5	157.4	3.9	260.0	370
4	4	22	23.0	1643	8.7	187.5	228.8		241.0	410
<u>1970</u>										
12-30	364	15	20.0	1573	8.7	289.0	352.6		25.0	400
16	350	24	20.0	1650	8.9	266.0	324.5			
14	348	21	20.0	1221	8.5	173.0	211.1			
9	343	24	16.0	1440	8.6	126.0	153.7		243.0	400
7	341	24	23.0	1612	8.0	201.0	245.2			
11-5	309	Grab	24.0	1357	7.8					
4	308	Grab								
1	306	24	13.0		6.7	92.0	112.2			
10-28	301	24	17.0	1746	7.2	186.8	227.9		229.7	302
26	299	24			7.2	205.0	250.1		228.0	316
21	294	Grab	24.0	1663						
20	293	Grab	25.0	1575	7.3	205.0	250.1			375
19	292	Grab	26.0	1372					220.0	
15	288	Grab	25.0	1100	7.7	217.0	264.7		246.0	385
12	285	24	25.0	1580	7.6	231.0	281.8		208.0	300
9	282	Grab	22.0	1590	7.7	273.0	333.1		205.0	220
5	278	Grab	24.0	1561						
9-30	273	Grab	20.0	1623	7.3	211.0	257.4		223.0	365

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 1 (CONTINUED)
analysis as mg/l

1970	Day Hours		micro		pH	Total as CaCO ₂	Alkalinity			SO ₄
			Temp °C	mhos/cm at 25°C			HCO ₃	CO ₃	Cl	
8-26	238	24	18.0	1541	7.6	134.7	164.3		216.9	400
24	236	24	22.0	1484	7.4	154.3	188.3		218.0	375
19	231	24	20.0	1496	7.6	252.0	307.4		200.0	330
17	229	24	21.0	2534	7.8	109.0	133.0		239.0	385
12	224	24	20.0	1562	7.2	107.0	130.5		232.0	366
11	223	24								
10	222	23	18.0		7.5	153.0	186.7		239.0	366
6	218	24								
5	217	24	25.0	1420	7.5					
4	216	24								
3	215	24	21.0	1236	7.9	168.0	205.0		236.0	350
7-30	211	24								
28	209	24								
27	208	24								
23	204	24								
22	203	24	21.0	1296	7.4					
20	201	24	23.0	1498	7.1	99.6	122		234.0	366
15	196	24	18.0	1518	7.1	139.0	170		209.0	380
13	194	21.5	19.0	1639						
9	190	24	14.0	1764						
7	188	24	26.0	1568	7.4	181.0	221		243.0	380
6-25	176	24	20.0	1540						
23	174	24	19.0	1492	7.4	101.0	123		238.0	356
18	169	22	17.0	1463	7.2					
16	167	24	18.0	1610						
14	165	24				145.6			236	426
11	162	24	16.0	1680						
9	160	24	19.0	1582	7.7	110.0	134		234.0	416
4	155	24	18.0	1633	7.1	143.0	175		240.0	390
2	153	24	18.5	1642						

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE SAMPLES, PART 1 (CONTINUED)

1970	Day	Hours	micro-		pH	Alkalinity				
			Temp °C	mhoh/cm at 25°C		Total as CaCO ₂	HCO ₃	CO ₃	Cl	SO ₄
5-26	146	24	18.0	1587						
21	141	24	16.0	1560	7.2					
19	139	24	18.0	1656	9.0	147.0	77.5	19.1		
14	134	24	21.0	1577		112.0	137		221.0	350
13	133	24	22.0	1611	7.3					
11	131	24	20.0	1584						
10	130	24	19.0	1627						
6	126	24	22.0	1569						
5	125	24	20.0	1562		130.0	159		236.0	393
4	124	24	21.0	1620						
3	123	24	20.0	2090						
4-28	118	24			7.4	142.0	173		238.0	380
27	117	24								
26	116	24			7.3					
23	113	24								
22	112	24			7.6	113.0	138		238.0	383
21	111	24								
19	109	24			7.3	108.0	132			
16	106	24			7.2	111.0	135			
3-18	77	24			7.4					
15	74	24			7.4					
12	71	24			8.5					
11	70	24								
10	69	24								
5	64	24			7.5					
4	63	24								
2	61	24								
1	60	24			7.0					
2-25	56	24								
23	54	24								
18	49	24								
16	47	24								
12	43	24								
9	40	24								
5	36	24								
3	34	24								

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
 SAMPLES, PART 1 (CONTINUED)
 analysis as mg/l

1970	Day	Hours	micro-		pH	Total as CaCO ₂	Alkalinity			Cl	SO ₄
			Temp °C	mos/cm at 25°C			HCO ₃	CO ₃			
1-29	29	24			6.7	108.0				269.3	
25	25	24			6.8	159.0				247.5	330

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 2

analysis as mg/l

1971	Day	Phosphate Unfiltered		Phosphate Filtered		Nitrate	
		Total PO ₄	P	Total PO ₄	P	Ortho PO ₄	N
6-30	181			1.07	0.35	0.92 0.30	4.34 0.98
28	179	0.86	0.28			0.73 0.24	2.66 0.60
23	174	1.74	0.57			1.10 0.36	2.22 0.50
21	172	1.16	0.38			1.07 0.35	11.08 2.50
16	167	1.65	0.54			1.32 0.43	2.22 0.50
14	165	1.35	0.44			1.32 0.43	1.51 0.34
9	160						
7	158	1.01	0.33			0.83 0.27	7.09 1.60
2	153	2.60	0.85			2.45 0.80	7.53 1.70
5-31	151	3.06	1.00			2.82 0.92	0.93 0.21
26	146	6.73	2.20			6.43 2.10	5.32 1.20
24	141	6.73	2.20			6.12 2.00	5.76 1.30
19	139	9.18	3.00			8.26 2.70	5.76 1.30
17	137					5.81 1.90	5.20 1.40
12	132					5.66 1.85	6.20 1.40
10	130					3.86 1.27	4.43 1.00
5	125	3.82	1.25			3.82 1.25	6.64 1.50
3	123	2.51	0.82			2.26 0.74	5.76 1.30
4-28	118						
26	116	6.73	2.20			6.73 2.20	6.20 1.40
21	111	6.58	2.15			5.05 1.65	8.86 2.00
19	109						7.09 1.60
14	104	6.73	2.20			6.73 2.20	6.64 1.50
12	102	4.13	1.35				5.32 1.20
5	95	4.44	1.45				7.53 1.70
3-31	90						
29	88	6.12	2.00				5.76 1.30
24	83	3.52	1.15				7.53 1.70
22	81			6.12	2.00		6.20 1.40
17	76	5.06	1.85				8.86 2.00
15	74	6.73	2.20				10.63 2.40
3	62	5.51	1.80				8.42 1.90
1	60	5.81	1.90				6.64 1.50

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 2 (CONTINUED)
analysis as mg/l

1971	Day	Phosphate Unfiltered		Phosphate Filtered		Nitrate	
		Total PO ₄	Ortho P	Total PO ₄	Ortho P	NO ₃	N
2-25	56	1.29	0.42			4.21	0.95
22	53	2.26	0.74			4.43	1.00
17	48	5.81	1.90		5.29 1.73	3.54	0.80
15	46						
10	41	2.88	0.94			3.99	0.90
8	39	4.13	1.35			4.87	1.10
3	34	1.41	0.46			6.20	1.40
1-27	27	1.38	0.45			3.63	0.82
25	25	0.66	0.22			1.15	0.26
19	19						
13	13	1.71	0.56			3.54	0.80
11	11						
6	6	0.12	0.04			0.58	0.13
4	4	2.05	0.67			1.51	0.34
<u>1970</u>							
12-30	364	3.37	1.10			1.64	0.37
16	350	3.37	1.10			0.84	0.19
14	348	2.69	0.88			0.80	0.18
9	343	1.93	0.63			1.37	0.31
7	341	2.26	0.74			1.64	0.37
11-5	309						
4	308						
1	306						
10-28	301					1.42	0.32
26	299	3.10	1.01			1.24	0.28
21	294						
20	293						
19	292						
15	288	3.00	1.98			0.75	0.17
12	285						
9	282						
5	278						
9-30	273	10.80	3.53			5.32	1.20

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 2 (CONTINUED)
analysis as mg/l

1970	Day	Phosphate Unfiltered		Phosphate Filtered		Nitrate	
		Total PO ₄	Ortho P	Total PO ₄	Ortho P	NO ₃	N
8-26	238	2.30	0.75			19.49	4.40
24	236	1.75	0.57			21.26	4.80
19	231	1.90	0.62			2.66	0.60
17	229	1.90	0.62			19.49	4.40
12	224	1.50	0.49			17.72	4.00
11	223						
10	222	2.55	0.83			17.72	4.00
6	218						
5	217						
4	216					15.95	3.60
3	215	2.30	0.75			20.38	4.60
7-30	211						
28	209						
27	208						
23	204						
22	203					6.20	1.40
20	201					88.60	20.00
15	196	2.94	0.96			11.52	2.60
13	194						
9	190						
7	188	3.35	1.09			44.30	10.00
6-25	176						
23	174	0.95	0.31			48.73	11.00
18	169						
16	167						
14	165	1.00	0.03			4.87	1.10
11	162					1.10	0.02
9	160	1.70	0.56			4.87	1.10
4	155	3.00	0.98			48.73	11.00
2	153						

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 2 (CONTINUED)
analysis as mg/l

1970	Day	Phosphate Unfiltered		Phosphate Filtered		Nitrate	
		Total PO ₄	P	Total PO ₄	P	Ortho PO ₄	N
5-26	146						
21	141						
19	139	1.60	0.52				99.68 22.50
14	134	0.95	0.31			0.90 0.29	37.66 8.50
13	133						
11	131						
10	130						
6	126						
5	125	1.25	0.41				110.8 25.00
4	124						
3	123						
4-28	118	2.30	0.75			2.30 0.75	53.16 12.00
27	117						
26	116						
23	113						
22	112	2.30	0.75			1.70 0.55	44.30 10.00
21	111						
19	109						
16	106						
3-18	77						
15	74						
12	71						
11	70						
10	69						
5	64						
4	63						
2	61						
1	60						
2-25	56			1.30	0.42		14.40 3.25
23	54			1.90	0.62		33.23 7.50
18	49			1.80	0.59		33.23 7.50
16	47	1.40	0.46				53.38 12.50
12	43	1.35	0.44				8.42 1.90
9	40	2.50	0.82				14.40 3.25
5	36	1.35	0.44				26.58 6.00
2	34	1.10	0.36				31.01 7.00

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
 SAMPLES, PART 2 (CONTINUED)
 analysis as mg/l

1970	Day	Phosphate Unfiltered		Phosphate Filtered		Nitrate	
		Total	Ortho	Total	Ortho	NO ₃	N
		PO ₄	P	PO ₄	P	PO ₄	P
1-29	29	0.70	0.23			31.01	7.00
25	25					3.54	0.80

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 3

analysis as mg/l

1971	Day	Nitrite		Ammonia		Organic	Calcium		Magnesium	
		NO ₂	N	NH ₄	N	N	Ca	CaCO ₃	Mg	CaCO ₃
6-30	181	0.92	0.28	5.28	4.10	4.60	124.2	311	4.9	20.1
28	179	0.28	0.09	10.05	7.80	2.40	130.6	327	3.4	13.9
23	174	0.82	0.25	8.90	6.90	0.90	93.7	234	12.2	50.0
21	172	0.92	0.28	10.05	7.80	0.39	113.7	284	15.6	64.0
16	167	1.61	0.49	11.72	9.10	1.70	96.1	240	18.0	73.8
14	165	2.01	0.61	11.59	9.00	0.31	110.5	276	9.7	39.8
9	160	1.51	0.46	0.13	0.10	2.51	163.4	409	0.0	0.0
7	158	1.05	0.32	0.10	0.08	0.62	147.4	369	6.8	27.9
2	153	0.16	0.05	0.09	0.07	1.05	148.2	371	5.4	22.1
5-31	151	0.25	0.08	1.42	1.10	1.13	144.2	361	6.3	25.8
26	146	0.56	0.17	2.19	1.70	2.77	101.7	254	33.1	136
24	144	0.86	0.26	0.18	0.13	1.73	98.5	246	33.1	136
19	139	1.18	0.36	0.13	0.10	2.92	120.2	301	33.6	138
17	137	1.58	0.48				118.5	296	31.2	128
12	132	1.18	0.36	0.22	0.17	1.94	110.5	276	39.0	160
10	130						116.1	290	36.0	148
5	125	0.56	0.17	1.74	1.35	6.85	116.9	292	35.6	150
3	123	0.56	0.17				111.3	278	33.6	138
4-28	118									
26	116	0.70	0.23	5.42	4.20	1.50	112.1	280	35.6	146
21	111	1.61	0.49	3.03	2.35	1.55	125.8	315	37.5	154
19	109	1.05	0.32	2.58	2.00	6.10	114.0	285	42.9	176
14	104	0.39	0.12	1.76	1.37	0.65	120.2	301	35.6	150
12	102	0.46	0.14	3.25	2.52	8.17	117.7	294	33.1	136
5	95	1.32	0.40	1.16	0.90	0.55	111.3	278	39.5	162
3-31	90						107.3	268	36.5	150
29	88	0.36	0.11	3.99	3.10	9.80	120.1	300	37.5	154
24	83	0.72	0.22	0.18	0.14	0.76	130.6	327	37.5	154
22	81	0.36	0.11	5.22	4.05	4.05	125.8	315	36.5	150
17	76	0.39	0.12	0.35	0.27	3.33	125.8	315	35.1	144
15	74	0.39	0.12	2.70	2.10	2.70	109.7	274	41.4	170
3	62	0.63	0.19	1.08	0.84	1.86	120.2	301	35.1	144
1	60	0.56	0.17	5.92	4.60	0.20	119.4	299	35.6	150

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 3 (CONTINUED)

analysis as mg/l

1971	Day	Nitrite		Ammonia		Organic	Calcium		Magnesium	
		NO ₂	N	NH ₄	N	N	Ca	CaCO ₃	Mg	CaCO ₃
2-25	56	0.53	0.16	3.10	2.40	4.30	107.3	268	31.7	130
22	53	0.59	0.18	8.76	6.80	0.10	117.7	294	30.2	124
17	48	0.30	0.09	10.43	8.10	4.10	99.3	248	39.9	164
15	46									
10	41	0.46	0.14	15.84	12.30	4.60	90.5	226	34.1	140
8	39	0.89	0.27	10.82	8.40	3.30	96.9	242	33.1	136
3	34	1.12	0.34	11.08	8.60	1.90	92.9	232	29.2	120
1-27	27	0.56	0.17	13.78	10.70		113.7	284	18.0	73.8
25	25	0.63	0.19	17.52	13.60	7.30	96.1	240	33.1	136
19	19									
13	13	0.49	0.15	5.41	4.20	0.60	123.4	309	21.9	89.8
11	11	1.45	0.44				116.9	292	28.7	118
6	6	1.12	0.34	5.15	4.00	2.90	107.3	268	18.5	75.9
4	4	0.82	0.25	16.87	13.10	1.60	108.9	272	28.2	116
<u>1970</u>										
12-30	364	0.66	0.20	9.76	7.58	6.52	103.3	258	39.0	160
16	350	0.79	0.24	3.28	2.55	9.45	143.4	359	1.0	4.1
14	348	0.63	0.19	18.16	14.10	3.60				
9	343	1.32	0.40	13.27	10.30	2.00	80.1	200	16.1	66.1
7	341	1.32	0.40	12.89	10.00	0.80	92.9	232	27.8	114
11-5	309									
4	308									
1	306						45.7	114	6.3	25.8
10-28	301	11.84	3.60				116.1	290	14.6	59.9
26	299	4.28	1.30				118.5	296	12.7	52.1
21	294									
20	293						84.9	212	20.9	85.7
19	292									
15	288	1.65	0.50		7.90	33.50	82.5	206	27.3	112
12	285						96.1	240	17.0	69.7
9	282						105.0	263	26.3	108
5	278									
9-30	273	0.72	0.22	10.18	9.74	12.76	105.7	264	25.3	104

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 3 (CONTINUED)
analysis as mg/l

1970	Day	Nitrite		Ammonia		Organic	Calcium		Magnesium	
		NO ₂	N	NH ₄	N	N	Ca	CaCO ₃	Mg	CaCO ₃
8-26	238	0.10	0.03	0.34	0.26	0.96	108.1	270	16.6	68.1
24	236	0.59	0.18	0.34	0.26	0.65	129.8	325	7.8	32.0
19	231	0.13	0.04	10.58	8.21	4.56	72.1	180	31.7	130
17	229	0.00	0.00	0.40	0.31	3.34	112.1	280	12.7	52.1
12	224	0.39	0.12	0.27	0.21	4.96	96.9	242	20.0	82.0
11	223									
10	222	0.49	0.15	0.49	0.38	5.09	108.1	270	25.8	106
6	218									
5	217									
4	216									
3	215	0.66	0.20	0.19	0.15	0.15	98.5	246	16.1	66.0
7-30	211									
28	209									
27	208									
23	204									
22	203									
20	201	4.77	1.45	5.49	4.26	4.56	111.3	278	9.3	38.1
15	196	1.32	0.40	7.24	5.62		97.7	244	17.0	69.7
13	194									
9	190									
7	188	4.15	1.26	5.19	4.03		113.7	284	13.1	53.7
6-25	176									
23	174	3.45	1.05	2.25	1.75	0.68	107.3	268	13.6	55.8
18	169									
16	167									
14	165	0.53	0.16	0.76	0.59		128.0	320	18.0	73.8
11	162									
9	160	0.95	0.29	0.60	0.45	1.98	105.0	262	24.8	102
4	155	2.07	0.63	0.81	0.63	2.11	116.0	290	22.4	91.8
2	153									

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
 SAMPLES, PART 3 (CONTINUED)
 analysis as mg/l

1970	Day	Nitrite		Ammonia		Organic	Calcium	Magnesium	
		NO ₂	N	NH ₄	N	N	Ca	CaCO ₃	Mg
5-26	146								
21	141								
19	139			0.13	0.10	5.07			
14	134	2.14	0.65	1.44	1.12		116.0	290	8.8
13	133								36.1
11	131								
10	130								
6	126								
5	125	0.26	0.08	0.04	0.03		100.0	250	31.6
4	124								130
3	123								
4-28	118	0.46	0.14				96.9	242	28.8
27	117								118
26	116								
23	113								
22	112								
21	111	0.63	0.19				96.9	242	22.9
19	109								93.9
16	106								
3-18	77								
15	74								
12	71								
11	70								
10	69								
5	64								
4	63								
2	61								
1	60								
2-25	56	0.04	0.01	0.49	0.38	1.07			
23	54	0.26	0.08	4.25	3.30	1.60			
18	49	0.11	0.03	0.00	0.00	14.20			
16	47	0.20	0.06	0.72	0.56	3.84			
12	43	0.66	0.20	0.82	0.64	4.58			
9	40	0.59	0.18	5.80	4.50	2.70			
5	36	9.48	2.88	0.36	0.28	1.46			
3	34	0.06	0.02	0.63	0.49	4.46			

**TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 3 (CONTINUED)**
analysis as mg/l

1970	Day	Nitrite		Ammonia		Organic N	Calcium		Magnesium	
		NO ₂	N	NH ₄	N		Ca	CaCO ₃	Mg	CaCO ₃
1-29	29	0.53	0.16	2.61	2.03	2.37	119.3	298	24.3	99.6
25	25	16.45	5.00	1.16	0.90	0.85	106.5	266	27.2	112

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 4

analysis as mg/l

1971	Day	TH	Na	K	Fe	Mn	Cr	SiO ₂	mev/l	
									Cation	Anion
6-30	181	330	250	23.6	0.20			5.25	18.4	18.5
28	179	340	255	24.8	0.24			6.00	19.1	19.2
23	174	284	250	24.0	0.13			7.00	17.7	18.1
21	172	348	240	22.8	0.22			13.00	18.5	19.0
16	167	314	230	22.8	0.07			8.00	17.5	17.6
14	165	356	220	23.6	0.03			3.25	17.9	17.8
9	160	408	225	24.4	0.18			3.25		
7	158	396	225	24.4	0.17			4.00	18.4	18.0
2	153	392	232	24.0	0.13			4.50	18.6	18.6
5-31	151	412	225	24.4	0.24			1.50	18.7	18.8
26	146	390	225	23.6	0.05			2.75	18.3	18.4
24	144	382	225	21.6	0.03			7.00	18.0	17.9
19	139	438	225	24.0	0.10			5.75	19.2	19.1
17	137	424								
12	132	436	237	24.4	0.05			11.50	19.7	20.0
10	130		438							
5	125	438	230	23.2	0.04			17.50	19.4	19.4
3	123	416								
4-28	118									
26	116	426	280	20.4	0.10			20.00	21.5	21.6
21	111	468								
19	109	460								
14	104	446	224	20.0	0.08			8.25	19.3	19.3
12	102	430	196	21.6	0.05			11.25		
5	95	440	260	19.2	0.06			10.75	20.7	20.7
3-31	90	418								
29	88	454	252	19.6	0.15			20.00	20.8	20.7
24	83	480	228	20.0	0.25			7.75	20.1	19.9
22	81	464	236	20.0	0.04			18.25	20.4	20.5
17	76	458	216	20.0	0.15			19.25	19.1	19.1
15	74	444	216	20.0	0.10			21.00	18.9	19.1
3	62	444	228	20.0	0.18			12.75	19.0	19.1
1	60	444	235	18.7	0.25			23.00	19.9	19.6

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 4 (CONTINUED)
analysis as mg/l

1971	Day	TH	Na	K	Fe	Mn	Cr	SiO ₂	mev/l	
									Cation	Anion
2-25	56	398	225	18.0	0.06			12.50	18.1	17.9
22	53	418	224	19.3	0.04			17.00	19.1	19.1
17	48	412	235	20.0	0.06			11.50	19.6	19.3
15	46					0.32				
10	41	366	236	20.0	0.05			15.50	19.0	19.0
8	39	378	240	19.3	0.10			10.00	10.1	19.1
3	34	352	235	20.0	0.08			13.50	18.4	18.7
1-27	27	358	246	20.0				11.10	18.6	18.6
25	25	376	240	17.5						
19	19						0.00			
13	13	398	240	19.0	0.04			2.00	17.3	16.8
11	11	410				0.07				
6	6	344	230	20.0	0.06			5.40	17.7	17.0
4	4	388	240	19.0	0.08			13.00		
<u>1970</u>										
12-30	364	418	246	19.0					20.1	20.3
16	350	362						12.80		
14	348									
9	343	266	252	17.6	0.04				17.3	17.3
7	341	346								
11-5	309									
4	308									
1	306	140								
10-28	301	352	210	18.8	0.00					
26	299	348	208	18.0					17.0	16.5
21	294									
20	293	298	212		0.40					
19	292									
15	288	318		20.8	0.12				17.4	18.7
12	285	310	204		0.12					
9	282	370	180		0.18					
5	278									
9-30	273	368	212	18.4	0.20				17.8	17.8

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 4 (CONTINUED)
analysis as mg/l

1970	Day	TH	Na	K	Fe	Mn	Cr	SiO ₂	mev/l	
									Cation	Anion
8-26	238	338	216	18.4	0.12				16.7	16.9
24	236	356	208	18.4	0.14				16.7	16.9
19	231	310	216	19.6	0.14				16.7	16.7
17	229	336	220	20.0	0.08				16.7	16.9
12	224	324	208	20.0	0.12				16.1	16.2
11	223									
10	222	376	216	20.4	0.12				17.5	17.0
6	218									
5	217									
4	216									
3	215	390	224	19.6	0.00				16.7	17.1
7-30	211									
28	209									
27	208									
23	204									
22	203									
20	201	316	212	18.4					16.2	16.2
15	196	314	212	17.2					16.2	16.2
13	194									
9	190									
7	188	338	243	18.8					18.0	18.0
6-25	176									
23	174	324	206	17.8					16.0	16.0
18	169									
16	167									
14	165	394	224	19.2					18.1	18.0
11	162									
9	160	364	216	18.4					17.2	17.2
4	155	382	220	19.0					17.7	17.8
2	153									

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
 SAMPLES, PART 4 (CONTINUED)
 analysis as mg/l

1970	Day	TH	Na	K	Fe	Mn	Cr	SiO ₂	mev/l	
									Cation	Anion
5-26	146									
21	141									
19	139		235	20.0						
14	134	326	205	20.0						
13	133									
11	131									
10	130									
6	126									
5	125	380	216	19.0					17.5	17.5
4	124									
3	123									
4-28	118	366	224	19.2					17.4	17.3
27	117									
26	116									
23	113									
22	112									
21	111	336	232	14.4					17.2	17.0
19	109									
16	106									
3-18	77									
15	74									
12	71									
11	70									
10	69									
5	64									
4	63									
2	61									
1	60									
2-25	56									
23	54									
18	49									
16	47									
12	43									
9	40									
5	36									
3	34									

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
 SAMPLES, PART 4 (CONTINUED)
 analysis as mg/l

1970	Day	TH	Na	K	Fe	Mn	Cr	SiO ₂	mev/l	
									Cation	Anion
1-29	29	398								
25	25	378								

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 5

analysis as mg/l

1971	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		Total Dissolved Solids
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	
6-30	181	18.3	15.7		1.4	20		20	1000
28	179	13.5	9.8		1.0	5		22	1135
23	174	14.0	13.0		1.1	10		12	1140
21	172	14.4	13.6		0.8	5		23	1205
16	167	16.8	16.4		1.1	5		20	1230
14	165	14.2	12.7		1.7	5		14	1190
10	160	12.2	9.8		0.4	5		33	1385
7	158	6.1	5.7		0.6	5		13	1385
2	153	12.9	10.1		0.8	5		14	1360
5-31	151	12.7	12.0		0.6	5		28	1410
26	146	15.8	15.1		1.0	5		19	1190
24	144	17.4	12.5		0.7	5		27	1330
19	139	12.7	11.9		0.9	5		26	1410
17	137	26.7	10.5		0.6	5		24	1428
12	132	11.2	8.4		1.0	5		14	1445
10	130	11.0	9.9		1.5	5		12	1365
5	125	11.5	10.0		1.5	5		8	1355
3	123	6.0	5.1						
4-28	118	13.2	9.4						1352
26	116	8.9	8.0		1.4	5		26	1360
21	111	8.9	8.5	2.4	1.5	15		15	1400
19	109	11.0	6.4		1.25	5		14	1455
14	104	11.3	10.9		1.1	5		10	1335
12	102	11.6	11.2		1.3	10		21	1340
5	95	3.8	3.0		1.1	5		26	1350
3-31	90	14.6	13.3		0.5	5		18	1270
29	88	15.2	14.4		1.6	10		34	1580
24	83	12.2	12.2		1.1	10	16	17	1470
22	81	19.0	17.8		1.3	5		23	1355
17	76	16.1	13.3	0.8	1.0	5	16	19	1500
15	74	14.8	13.9		2.0	5	23	26	1330
3	62	24.8	22.2	8.8	2.4	5	5	10	1325
1	60	15.0	15.0		1.6	10	9	10	1225

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 5 (CONTINUED)
analysis as mg/l

1971	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		Total Dissolved Solids
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	
2-25	56	20.7	17.5	12.0	1.4	5	9	12	1270
22	53	13.9	11.4		1.6	5	6	21	1275
17	48	23.5	20.0	7.6	1.8	10	14	20	1275
15	46	20.4	19.7					6.8	
10	41	14.5	12.2		1.5	15	20	21	1045
8	39	15.7	13.1		2.0	5	12	19	1105
3	34	20.3	19.1	3.6	0.9	10	6	11	1380
1-27	27	16.7	15.2	12.4	0.8	10	13	28	1285
25	25	27.5	23.9	6.4	1.4	5	15	47	1740
19	19								
13	13	14.6	10.2		1.7	5	6	19	1245
12	12			5.4					
11	11	18.1	16.8		2.5	5		11	
6	6	16.8	15.0		1.3	5	10	16	
4	4	20.5	20.2		2.5	5	13	18	1390
<u>1970</u>									
12-30	364	24.4							1285
16	350	17.1	15.3		2.0	5	27	32	1205
14	348	7.7	5.5		2.3		17	45	
9	343	14.1	13.0		1.0	10			1030
7	341	15.8	14.4		2.7	15	34	71	1370
11-5	309	25.7	23.3		0.4	10	15	25	1205
4	308	15.0							
1	306	11.2	9.4		0.7	5	10	27	1230
10-28	301	17.9	16.3		0.9		14	22	1105
26	299	26.4	24.3		0.6	10	6	23	1205
21	294	20.8	20.8						1070
20	293	9.1	8.4		3.6		13	27	1125
19	292	10.3	9.1						1110
15	288	17.2	16.8		1.4				1145
12	285	17.1	14.7		3.0		20	45	1170
9	282	19.1	16.4		5.5		18	21	1020
5	278	29.0	22.2						1080

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 5 (CONTINUED)
analysis as mg/l

1970	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		Total Dissolved Solids
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	
9-30	273	18.1	17.2		2.8				1200
8-26	238	12.7	11.9		0.2	5			1160
	24	236	13.1	12.7	0.35	5			1190
	19	231	22.5	20.0	3.7	5			1050
	17	229	11.2	10.7	0.2	5			1160
	12	224	14.9	13.5	0.2	10			1180
	11	223							
	10	222	15.4	15.2	0.3	5			1190
	6	218							
	5	217	8.4	4.8	0.2	10			1215
	4	216							
	3	215	18.7	15.8	0.2				1270
7-30	211								
	28	209							
	27	208							
	23	204							
	22	203	9.7	8.6	0.4	10			1000
	20	201	16.1	14.2	0.3				1100
	15	196	17.4	16.1	0.4	5			1170
	13	194	12.2	10.1	0.3				1265
	9	190	9.0	6.0	0.3				1235
	7	188	15.2	12.7	0.4				1220
6-25	176	23.0	21.3		0.3	5			1060
	23	174	34.1	21.2	0.2				1215
	18	169	23.7	18.2	0.5	5			1180
	16	167	6.85	6.85	0.4				
	11	162	13.5	10.7	0.2	5			
	9	160	14.6	13.9	0.4				
	4	155	12.3	10.3	0.4	5			
	2	153	6.7	6.1	0.5				

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
SAMPLES, PART 5 (CONTINUED)
analysis as mg/l

1970	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		Total Dissolved Solids
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	
5-26	146	9.2	7.3		0.2				
21	141	9.8	8.3		0.4	5			
19	139	13.1	11.9		0.9				
14	134	13.2							1125
13	133	8.5							1130
11	131	2.4							1260
10	130	7.4							1260
6	126	13.4							1225
5	125	3.8							1165
4	124	1.7							1350
3	123	1.1							1530
4-28	118	1.3							1180
27	117	26.1							
26	116	5.7							1230
23	113	0.0							1070
22	112	1.2							1165
21	111								1216
19	109	0.0			0.2				
16	106	12.0			0.5				
3-18	77	3.3			0.7				1240
15	74	5.1			0.6				
12	71	7.5			0.4				1136
11	70	7.9							1152
10	69	6.9							
5	64	8.9			0.6				1264
4	63	7.8							1200
2	61	8.1							1140
1	60	10.3			0.0				
2-25	56	4.7			0.1				
23	54	2.0							
18	49	11.6			0.1				
16	47	18.6			0.3				
12	43	7.9			0.7				
9	40	6.9			0.4				
5	36	6.7							
3	34	5.1							

TABLE D-3 ELECTRODIALYSIS DEMINERALIZER INFLUENT, COMPOSITE
 SAMPLES, PART 5 (CONTINUED)
 analysis as mg/l

COD as mg/l			BOD Dis- as		Turbidity	Color	Analysis as mg/l		Total
1970	Day	Total	solved	mg/l	J.T.U.	Units	Suspended	Susp.	Dissolved
							Solids	Solids	Solids
1-29	29	8.0							1176
25	25	6.7			0.5				

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE SAMPLES, PART 1

1971	Sample		Analysis as mg/l			Alkalinity			
	Day	Hours	Temp °C	micro-mhos/cm at 25°C	pH	Total as CaCO ₃	HCO ₃	CO ₃	Cl SO ₄
6-30	181	18	21.0	769	7.2	52.5	64.1		91.9 210
6-28	179	24	20.0	693	7.5	67.3	82.1		65.5 215
6-23	174	24	20.0	968	7.7	76.6	93.5		117.4 210
6-21	172	24	23.0	988	7.5	102.6	125.2		112.5 260
6-16	167	16	13.0	847	7.6	68.4	83.5		77.3 225
6-14	165	18			7.2	66.8	81.5		74.3 210
6-9	160	24	18.0	874	8.0	91.2	111.3		78.7 270
6-7	158	24	18.0	851	7.4	66.8	81.5		81.6 250
6-2	153	24	21.0	972	7.8	81.5	99.4		96.1 290
5-31	151	24	16.0	984	8.0	92.9	113.3		76.0 290
5-26	146	24	13.0	778	7.1	78.2	95.4		64.0 235
5-24	144	24	24.0	857	7.2	89.6	109.3		76.8 215
5-19	139	24	23.0	827	6.9	71.2	86.7		65.1 240
5-17	137	19	15.0		7.0	97.5	119.0		82.5 240
5-12	132	24	23.0	936	7.2	96.2	117.4		115.5 215
5-10	130	24	19.0		7.4				87.4 240
5-5	125	24	20.0	979	7.4	94.9	115.8		82.5 215
5-3	123	24	18.0		7.1	75.5	92.1		75.9 180
4-28	118	24	18.0		7.3				
4-26	116	24	22.0	848	6.8	115.2	140.5		68.0 225
4-21	111	24	23.0	946	7.4	91.4	111.5		84.0 380
4-19	109	14	21.0		7.0	93.0	113.5		
4-14	104	24	20.0	933	7.5	86.4	105.4		80.9 360
4-12	102	24	20.0	893	7.3	70.8	86.4		75.9 340
4-5	95	24	21.0	832	7.1	63.6	77.6		69.0 235
3-31	90	15	12.5		7.0	70.8	86.4		
3-29	88	17	20.0	1188	7.6	140.3	171.2		127.1 310
3-24	83	15	23.0	978	7.5	103.3	126.0		86.1 255
3-22	81	24	22.0	1007	7.3	143.0	174.5		84.1 240
3-17	76	24	18.0	955	7.0	100.6	122.7		83.1 170
3-15	74	22	20.0	897	7.3	100.6	122.7		75.3 200
3-3	62	18	24.0	826	7.0	92.7	113.1		73.3 200
3-1	60	24	20.0	842	6.9	100.6	122.7		73.3 210

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 1 (CONTINUED)

1971	Sample		Analysis as mg/l							
	Day	Hours	Temp °C	micro- mhos/cm at 25°C	pH	Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
2-25	56		18.0	748	7.1	99.3	121.2		68.0	195
2-22	53	17	21.0	788	7.2	103.3	126.0		66.1	170
2-17	48	24	14.0	793	7.7	128.0	156.2		67.0	170
2-10	41	24	20.0	783	7.5	83.9	102.4		75.9	180
2-8	39	24	16.0	1062	8.5	141.4	160.0	6.4	102.5	250
2-3	34	13	20.0	737	8.7	45.7	40.2	8.0	66.0	210
1-28	28		18.0	817	8.8	85.3	80.4	12.0	68.0	200
1-13	13	19	15.0	824	7.4	68.5	83.6		77.3	200
1-12	12	19								
<u>1970</u>										
12-9	343	24	16.0	744	8.0	59.8	73.0		88.0	190
11-1	306	24	16.0	948	6.8	113.0	137.9			
10-28	301	24	18.0	736	6.6	76.6	93.5		56.2	238
10-26	300				6.5	79.6	97.1		44.4	210
10-21	294		20.0	625						
10-20	293		25.0	660	6.6	78.1	95.3			
10-19	292		24.0	643					54.2	210
10-15	288		25.0	668	7.0	91.9	112.1		70.0	275
10-12	285	24	25.0	690	6.9	98.0	119.6		55.2	205
9-30	273		20.0	836	7.5	121.0	147.6		81.8	210
8-26	238	16	19.0	644	6.9	50.5	61.6		52.3	225
8-24	237		24.0		7.5	143.1	174.6			
8-19	231	24	20.0	836	7.4	142.0	173.2		74.0	180
8-17	229	24	21.0	616	7.1	32.3	39.4		56.2	220
8-12	224	24	20.0	644	6.6	51.9	63.3		59.0	160
8-11	223	24								
8-10	222	24	18.0	667	6.9	66.0	80.5		50.3	190
8-5	217	24	25.0	850	7.1					
8-3	215	24	22.0	869	7.3	88.4	107.9		93.7	230

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 1 (CONTINUED)

1970	Sample Day Hours		Temp °C		micro- whos/cm at 25°C	pH	Analysis as mg/l Alkalinity				
							Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
7-22	203	24	21.0	637		7.1					
7-20	201	24	24.0	576		6.5	46.3	56.5		54.2	170
7-15	196	24	16.0	660		6.4	59.0	72.0		60.0	210
7-13	194	21	19.0	712							
7-9	190	24	14.0	804		7.2					
7-5	186	24	22.0	636							
6-28	179	24	17.0	708							
6-25	176	24	19.0	610							
6-23	174	24	18.0	667		6.9	56.9	69.4		68.0	230
6-21	172	24	15.0	664							
6-18	169	22	17.0	637		6.8					
6-14	165	24	15.0	627			63.5	77.5		62.0	180
6-4	155	24	17.0	802		7.2	68.8	83.9		78.9	220
5-21	141	24	15.0	763		6.7					
5-19	138					8.1	124.0	151.3			
5-14	134	24	21.0	756			56.0	68.3		80.5	266
5-13	133	24	21.0	756		7.1					
5-11	131	24	20.0	781							
5-10	130	24	18.0								
5-6	126	24	22.0	763							
5-5	125	24	20.0	737			62.0	75.6		79.5	226
5-4	124	24	21.0	896							
5-3	123	24	20.0								
4-28	118	24				7.2	75.0	91.5		80.5	220
4-27	117	24									
4-26	116	24									
4-23	113	24									
4-22	112	24									
4-21	111	24				7.0	58.0	70.8		81.5	243
4-20	110	24				7.2	75.0	91.5			
4-19	109	24				7.2	103.0	125.7			
4-16	106	24				6.4	61.5	75.5			

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 1 (CONTINUED)

1970	Sample		Temp °C	micro- mhos/cm at 25°C	pH	Analysis as mg/l Alkalinity				
	Day	Hours				Total as CaCO ₃	HCO ₃	CO ₃	Cl	SO ₄
3-18	77	24			7.0	77.7	94.8		98.9	174
3-12	71	24							71.3	
3-11	70	24			7.5	76.1	92.8			
3-5	64	24								
3-4	63	24								
3-2	61	24			8.1	102.0	124.4			163

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 2

1971	Day	Analysis as mg/l								Nitrate	
		Phosphate Unfiltered		Phosphate Filtered							
		Total PO ₄	P	Ortho PO ₄	P	Total PO ₄	P	Ortho PO ₄	P	NO ₃	N
6-30	181					1.13	0.37	0.77	0.25	2.39	0.54
6-28	179	0.58	0.19					0.40	0.13	2.17	0.49
6-23	174	1.16	0.38					1.03	0.34	2.22	0.50
6-21	172	1.07	0.35					0.64	0.21	0.66	0.15
6-16	167	1.13	0.37					0.80	0.26	0.75	0.17
6-14	165	0.80	0.26					0.80	0.26	0.53	0.12
6-9	160					0.70	0.23			2.22	0.50
6-7	158	0.69	0.23					0.46	0.15	1.33	0.30
6-2	153	1.81	0.59					1.65	0.54	2.44	0.55
5-31	151	2.05	0.67					1.84	0.60	3.10	0.70
5-26	146	5.35	1.75					5.20	1.70	1.42	0.32
5-24	144	2.51	0.82					2.05	0.67	1.46	0.33
5-19	139	7.77	2.54					5.75	1.88	1.33	0.30
5-17	137							6.00	1.55	1.82	0.41
5-12	132							4.28	1.40	1.46	0.33
5-10	130							3.37	1.10	1.51	0.34
5-5	125	3.06	1.00					3.06	1.00	2.92	0.66
5-3	123	1.38	0.45					1.10	0.36	2.22	0.50
4-28	118										
4-26	116	5.81	1.90					5.81	1.90	1.95	0.44
4-21	111	5.36	1.75					5.05	1.65	3.41	0.77
4-19	109									3.10	0.70
4-14	104	5.81	1.90					5.81	1.90	2.97	0.67
4-12	102	3.51	1.15							2.66	0.60
4-5	95	3.37	1.10							2.66	0.60
3-31	90										
3-29	88	5.51	1.80							5.32	1.20
3-24	83	5.81	1.90					5.05	1.65	4.43	1.00
3-22	81					5.05	1.65			8.86	2.00
3-17	76	4.44	1.45					4.44	1.45	4.43	1.00
3-15	74	5.81	1.50					5.36	1.75	4.21	0.95
3-3	62	3.67	1.20					3.21	1.05	3.54	0.80
3-1	60	5.05	1.65					4.28	1.40	2.97	0.67

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 2 (CONTINUED)

1971	Day	Analysis as mg/l								Nitrate	
		Phosphate Unfiltered		Phosphate Filtered							
		Total PO ₄	Ortho P	Total PO ₄	Ortho P	Total PO ₄	Ortho P	Total PO ₄	Ortho P	NO ₃	N
2-25	56	1.04	0.34					0.95	0.31	2.04	0.46
2-22	53	1.37	0.45					1.31	0.43	1.86	0.42
2-17	48	3.21	1.05					3.06	1.00	1.68	0.38
2-10	41	1.71	0.56					1.71	0.56	1.33	0.30
2-8	39	3.82	1.25					3.52	1.15	2.22	0.50
2-3	34	1.10	0.36					0.98	0.32	1.33	0.30
1-28	28	1.41	0.46					1.41	0.46	1.28	0.29
1-13	13	5.20	1.70					1.53	0.50	1.20	0.27
1-12	12										
<u>1970</u>											
12-9	343	1.22	0.40					1.10	0.36	0.66	0.15
11-1	306										
10-28	301									0.44	0.10
10-26	300	0.96	0.31			0.86	0.28			0.44	0.10
10-21	294										
10-20	293										
10-19	292										
10-15	288	2.50	0.82							0.44	0.10
10-12	285										
9-30	273					5.40	1.76			0.93	0.21
8-26	238	1.70	0.56							5.94	1.34
8-24	236										
8-19	231	1.20	0.39							1.59	0.36
8-17	229	1.76	0.58							6.20	1.40
8-12	224	0.60	0.20							5.32	1.20
8-11	223										
8-10	222	1.20	0.39							4.87	1.10
8-5	217										
8-3	215	2.30	0.75							8.86	2.00

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 2 (CONTINUED)

1970	Day	Analysis as mg/l								Nitrate	
		Phosphate Unfiltered				Phosphate Filtered					
		Total PO ₄	P	Ortho PO ₄	P	Total PO ₄	P	Ortho PO ₄	P	NO ₃	N
7-22	203										
7-20	201	0.00	0.00							23.26	5.25
7-15	196	2.35	0.77							5.76	1.30
7-13	194										
7-9	190										
7-5	186										
6-28	179										
6-25	176										
6-23	174	0.70	0.23							22.15	5.00
6-21	172										
6-18	169										
6-14	165	0.60	0.20							.34	.07
6-4	155	2.00	0.65							57.59	13.00
5-21	141										
5-19	138	2.15	0.70							11.08	25.00
5-14	134	0.80	0.26					0.75	0.25	22.15	5.00
5-13	133										
5-11	131										
5-10	130										
5-6	126										
5-5	125	0.95	0.31							99.68	22.50
5-4	124										
5-3	123										
4-28	118	1.60	0.52					1.50	0.49	21.04	4.75
4-27	117										
4-26	116										
4-23	113										
4-22	112										
4-21	111	1.45	0.47					1.30	0.42	42.09	9.50
4-20	110									44.30	10.00
4-19	109										
4-16	106									35.44	8.00

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 2 (CONTINUED)

Analysis as mg/l											
		Phosphate Unfiltered				Phosphate Filtered				Nitrate	
		Total		Ortho		Total		Ortho			
1970	Day	PO ₄	P	PO ₄	P	PO ₄	P	PO ₄	P	NO ₃	N
3-18	77	0.70	0.23							13.73	3.10
3-15	74										
3-12	71										
3-11	70									3.54	0.80
3-5	64										
3-4	63										
3-2	61									19.94	4.50

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 3

1971	Day	Analysis as mg/l								
		Nitrite NO ₂	N	Ammonia NH ₄	N	Organic N	Calcium Ca	Calcium CaCO ₃	Magnesium Mg	Magnesium CaCO ₃
6-30	181	1.22	0.37	5.92	4.60	2.20	30.4	76.0	9.7	39.8
6-28	179	0.92	0.28	3.93	3.05	0.65	35.2	88.0	2.9	11.9
6-23	174	1.61	0.49	4.60	3.60	1.20	30.4	76.0	7.3	29.9
6-21	172	1.61	0.49	5.41	4.20	1.01	36.8	92.0	11.2	45.9
6-16	167	0.56	0.17	3.99	3.10	2.50	24.0	60.0	7.8	32.0
6-14	165	0.30	0.09	5.54	4.30	0.17	28.0	70.0	4.4	18.0
6-10	160	0.33	0.10	0.06	0.05	1.81	56.1	140.3	1.5	6.2
6-7	158	0.56	0.17	0.00	0.00	0.37	47.3	118.3	2.9	11.9
6-2	153	0.13	0.04	0.06	0.05	0.69	54.5	136.3	6.8	27.9
5-31	151	0.29	0.09	0.08	0.06	1.06	52.9	132.3	2.4	9.8
5-26	146	0.43	0.13	0.48	0.37	0.37	30.4	76.0	13.1	53.7
5-24	144	1.41	0.43	0.13	0.10	2.13	32.0	80.0	12.7	52.1
5-19	139	0.36	0.11	0.04	0.03	1.48	35.2	88.0	12.2	50.0
5-17	137	0.56	0.17				39.2	98.0	13.6	55.8
5-12	132	0.39	0.12	0.04	0.03	0.88	38.4	96.0	14.6	60.0
5-10	130						44.1	110.3	15.6	64.0
5-5	125	0.33	0.10	0.35	0.27	3.63	40.9	102.3	15.6	64.0
5-3	123	0.30	0.09				36.0	90.0	19.0	77.9
4-28	118									
4-26	116	0.16	0.05	1.87	1.45	0.95	37.6	94.0	14.6	60.0
4-21	111	0.66	0.20	1.48	1.15	0.35	44.9	112.3	16.6	68.1
4-19	109	0.46	0.14	0.48	0.37	1.43	44.9	112.3	21.4	87.7
4-14	104	0.56	0.17	1.58	1.23	0.23	42.5	106.3	16.6	68.1
4-12	102	0.53	0.16	1.48	1.15	3.76	37.6	94.0	10.7	43.9
4-5	95	0.59	0.18	1.11	0.86	0.01	34.4	86.0	15.1	61.9
3-31	90						32.8	82.0	18.0	73.8
3-29	88	0.30	0.09	1.61	1.25	2.95	60.9	152.3	22.4	91.8
3-24	83	0.56	0.17	0.19	0.15	0.15	48.1	120.3	17.0	69.7
3-22	81	0.30	0.09	2.51	1.95	0.45	49.7	124.3	14.6	60.0
3-17	76	0.36	0.11	0.13	0.10	2.30	44.1	110.3	14.6	60.0
3-15	74	0.33	0.10	0.93	0.72	1.38	37.7	94.3	17.5	71.8
3-3	62	0.44	0.14	1.16	0.90	0.60	40.9	102.3	14.6	60.0
3-1	60	0.56	0.17	1.03	0.80	0.70	39.3	98.3	14.6	60.0

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 3 (CONTINUED)

1971	Day	Nitrite		Ammonia		Analysis as mg/l				
		NO ₂	N	NH ₄	N	Organic N	Calcium Ca	CaCO ₃	Magnesium Mg	CaCO ₃
2-25	56	0.49	0.15	3.00	2.30	0.10	30.4	76.0	16.6	68.1
2-22	53	0.43	0.13	3.35	2.60	2.20	36.0	90.0	12.7	52.1
2-17	48	0.26	0.08	4.51	3.50	0.10	32.0	80.0	18.0	73.8
2-10	41	0.49	0.15	7.21	5.60	1.00	28.8	72.0	11.7	48.0
2-8	39	0.46	0.14	8.11	6.30	5.10	36.0	90.0	17.0	69.7
2-3	34	0.59	0.18	6.05	4.70	1.30				
1-27	27	0.33	0.10	7.86	6.10	0.80	32.0	80.0	11.0	45.1
1-13	13	2.63	0.80	2.32	1.80	0.60	41.7	104.3	9.3	38.1
1-12	12									
<u>1970</u>										
12-9	343	0.76	0.23	6.48	5.03	0.07	31.2	78.0	5.4	22.1
11-1	306						45.7	114.3	6.3	25.8
10-28	301	0.76	0.23				34.4	86.0	6.3	25.8
10-26	300	1.71	0.52				36.9	92.3	2.4	9.8
10-21	294									
10-20	293						27.2	68.0	10.7	43.9
10-19	292									
10-15	288	0.72	0.22	8.81	6.84	17.06	27.2	68.0	9.7	39.8
10-12	285						30.4	76.0	6.8	27.9
9-30	273	0.46	0.14	1.25	0.97	8.13	35.2	88.0	10.7	43.9
8-26	238	0.00	0.00	0.40	0.31	0.30	32.0	80.0	7.3	29.9
8-24	236			0.10	0.08	1.74	129.0	322.5	7.3	29.9
8-19	231	0.00	0.00	1.66	1.29	10.57	23.2	58.0	17.0	69.7
8-17	229	0.00	0.00	0.12	0.09	2.34	34.4	86.0	5.4	22.1
8-12	224	0.00	0.00	0.18	0.14	2.90	29.6	74.0	6.3	25.8
8-11	223									
8-10	222	0.00	0.00	0.00	0.00	1.82	32.8	82.0	9.3	38.1
8-5	217									
8-3	215	0.03	0.10	0.31	0.24	0.06	38.5	96.3	14.6	59.9

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 3 (CONTINUED)

1970	Day	Analysis as mg/l								
		Nitrite		Ammonia		Organic	Calcium		Magnesium	
		NO ₂	N	NH ₄	N	N	Ca	CaCO ₃	Mg	CaCO ₃
7-22	203									
7-20	201	1.09	0.33	1.46	1.13		32.8	82.0	4.4	18.0
7-15	196	0.69	0.21	5.58	4.33		29.6	74.0	15.1	61.9
7-13	194									
7-9	190									
7-5	186									
6-28	179									
6-25	176									
6-23	174	1.32	0.40	5.58	4.33	1.75	32.8	82.0	3.41	14.0
6-21	172									
6-18	169									
6-14	165	0.16	0.05	0.19	0.15		28.0	70.0	12.2	50.0
6-4	155	0.43	0.13	0.24	0.19		25.6	64	18.0	73.8
5-21	141									
5-19	138	0.00	0.00	0.00	0.00					
5-14	134	0.89	0.27	1.04	0.81		39.2	98.0	7.3	29.9
5-13	133									
5-11	131									
5-10	130									
5-6	126									
5-5	125	0.07	0.02	0.00	0.00		32.5	81.3	13.0	53.3
5-4	124									
5-3	123									
4-28	118	0.13	0.04				32.0	80.0	20.9	85.7
4-27	117									
4-26	116									
4-23	113									
4-22	112									
4-21	111	0.23	0.07				35.2	88.0	11.2	45.9
4-20	110									
4-19	109									
4-16	106	0.33	0.10							

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 3 (CONTINUED)

1970	Day	Nitrite		Ammonia		Analysis as mg/l				Magnesium	
		NO ₂	N	NH ₄	N	Organic N	Calcium Ca	CaCO ₃	Mg	CaCO ₃	
3-18	77	0.33	0.10				50.5	126.3			
3-15	74										
3-12	71										
3-11	70	0.25	0.08				31.2	78.0	15.1	61.9	
3-5	64										
3-4	63										
3-2	61	0.14	0.04				44.0	110.0	20.4	83.6	

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 4

1971	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
6-30	181	116	115	13.6	0.13			7.00	8.0	7.9
6-28	179	100	125	7.2	0.07			6.00	7.8	7.7
6-23	174	106	155	12.0	0.10			6.50	9.4	9.2
6-21	172	138	170	13.6	0.03			13.50	10.8	10.7
6-16	167	92	135	8.4	0.15			7.00	8.2	8.2
6-14	165	98	120	7.6	0.15			7.75	7.7	7.8
6-9	160	150	145	8.8	0.18			2.50		
6-7	158	130	140	10.8	0.00			6.00	9.0	8.8
6-2	153	164	153	11.6	0.17			4.00	10.2	10.3
5-31	151	154	147	13.2	0.19			2.75	9.8	9.9
5-26	146	130	125	8.8	0.00			8.00	8.3	8.4
5-24	144	132	125	9.2	0.15			6.25	8.5	8.4
6-19	139	138	125	8.4	0.05			4.75	8.5	8.4
5-17	137	154								
5-12	132	156	150	11.2	0.15			14.00	10.0	9.9
5-10	130	174								
5-5	125	166	128	10.4	0.05			18.80	9.2	9.0
5-3	123	168								
4-28	118									
4-26	116	154	136	7.6	0.11			19.50	9.3	9.2
4-21	111	180	200	10.4	0.00			21.50	12.7	12.6
4-19	109	200								
4-14	104	174	180	10.0	0.10			4.00	11.7	11.5
4-12	102	138	172	8.8	0.04			7.25	10.9	10.7
4-5	95	148	120	6.0	0.06			12.80	8.4	8.4
3-31	90	156								
3-29	88	244	172	12.4	0.04			19.00	12.8	12.6
3-24	83	190	132	9.2	0.12			5.00	9.8	9.8
3-22	81	184	144	9.2	0.08			19.50	10.3	10.5
3-17	76	170	128	8.4	0.25			20.00	8.1	8.3
3-15	74	166	120	8.8	0.10			21.50	8.8	8.8
3-3	62	160	108	8.0				13.00	8.2	8.3
3-1	60	158	123	7.1	0.08			19.50	8.7	8.8

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 4 (CONTINUED)

1971	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
2-25	56	144	105	5.6	0.05			13.50	7.9	7.9
2-22	53	142	104	7.1	0.05			19.50	7.7	7.7
2-17	48	154	108	7.6	0.04			10.50	8.2	8.0
2-10	41	120	108	7.6	0.10			11.20	7.7	7.6
2-8	39	160	154	10.0	0.08			12.00	10.6	10.4
2-3	34	118	104	6.5	0.05			13.00	7.4	7.6
1-28	28	125	116	8.0	0.08			15.50	8.2	8.3
1-13	13	142	120	7.6	0.15			3.0	8.1	7.8
1-12	12									
<u>1970</u>										
12-9	343	100	116	6.4	0.11				7.5	7.4
11-1	306	140								
10-28	301	112	104	7.2	0.10					
10-26	300	100	104	5.2	0.00				6.7	7.0
10-21	294									
10-20	293	112	96		0.32					
10-19	292									
10-15	288	108	112	7.2	0.06					
10-12	285	104	96		0.08					
9-30	273	132	128	6.8	0.10				8.9	8.9
8-26	238	110	104	5.6	0.12				6.9	7.0
8-24	236	352								
8-19	231	128	124	8.4	0.12				8.3	8.2
8-17	229	108	92	5.6	0.08				6.7	6.9
8-12	224	100	86	5.6	0.08				5.9	5.9
8-11	223									
8-10	222	120	92	6.4	0.10				6.6	6.6
8-5	217									
8-3	215	156	128	9.6	0.00				9.0	9.1

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 4 (CONTINUED)

1970	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
7-22	203									
7-20	201	100	86	4.8	0.10				5.9	5.9
7-15	196	136	92	5.6	0.14				7.1	7.1
7-13	194									
7-9	190									
7-5	186									
6-28	179									
6-25	176									
6-23	174	96	125	6.0	0.08				7.7	7.7
6-21	172									
6-18	169									
6-14	165	120	92	4.8					6.5	6.7
6-4	155	138	120	7.0					8.3	8.3
5-21	141									
5-19	138		170	10.0						
5-14	134	128	105	7.5						
5-13	133									
5-11	131									
5-10	130									
5-6	126									
5-5	125	134.7	128	6.0					8.4	8.4
5-4	124									
5-3	123									
4-28	118	174	124	7.2					8.9	8.9
4-27	117									
4-26	116									
4-23	113									
4-22	112									
4-21	111	134	120	4.4					8.2	8.2
4-20	110									
4-19	109									
4-16	106									

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 4 (CONTINUED)

1970	Day	Total Hardness as CaCO ₃	Analysis as mg/l						mev/l	
			Na	K	Fe	Mn	Cr	SiO ₂	Cation	Anion
3-18	77	164	80	10.2					7.6	7.6
3-15	74									
3-12	71									
3-11	70	140	80	4.0					6.4	6.4
3-5	64									
3-4	63									
3-2	61	194	118	5.8					9.2	9.1

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 5

1971	Day	COD		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		as mg/l					Volatile Suspended Solids	Total Susp. Solids	Total Dissolved Solids
		Total	Dis- solved						
6-30	181	14.3	12.9		1.4	15		7	700
6-28	179	7.6	5.8		1.0	5		10	455
6-23	174	14.0	12.7		1.3	5		11	640
6-21	172	10.7	10.3		0.4	5		18	720
6-16	167	13.3	10.7		1.3	5		14	640
6-14	165	11.0	8.2		0.8	5		11	560
6-10	160	11.0	8.2		0.3	5		7	660
6-7	158	6.1	5.0		1.0	5		8	750
6-2	153	9.7	7.7		0.7	5		11	740
5-31	151	11.6	10.8		1.3	5		12	815
5-26	146	11.2	8.6		1.0	5		5	560
5-24	144	10.9	10.1		0.8	5		12	670
5-19	139	11.1	7.9		1.0	5		8	720
5-17	137	21.8	10.5		0.6	5		10	852
5-12	132	7.6	4.4		1.0	5		3	780
5-10	130	9.2	6.2		1.4	5		6	810
5-5	125	7.8	7.4		1.3	5		7	825
5-3	123	5.4	4.0						
4-28	118	12.8	9.4						744
4-26	116	5.1	2.5		1.6	5		12	660
4-21	111	8.9	6.4	1.0	1.5	5		10	740
4-19	109	7.3	6.4		1.1	5		4	800
4-14	104	9.0	7.5		1.3	5		6	745
4-12	102	9.2	8.8		1.4	5		4	660
4-5	95	3.0	2.6		0.8	5		3	645
3-31	90	11.6	8.2		0.5	5		4	645
3-29	88	9.5	8.7		1.8	10		23	1120
3-24	83	11.5	9.3		1.3	10	11	15	800
3-22	81	12.4	12.0		1.1	5		11	785
3-17	76	8.2	2.8	0.0	1.0	5	9	12	860
3-15	74	8.5			1.0	5	18	22	735
3-3	62	14.4	12.4	5.6	2.1	5	4	8	620
3-1	60	9.6			1.8	5	5	7	400

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 5 (CONTINUED)

1971	Day	COD as mg/l		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l		
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids	Total Dissolved Solids
2-25	56	9.4	22.8	23.6	1.0	5	7	8	620
2-22	53	5.1			1.5	5	5	12	570
2-17	48	14.5	13.7	6.8	1.5	5	3	6	650
2-10	41	8.6	6.7		1.3	10	6	18	630
2-8	39	10.0	8.8		1.0	5	8	8	645
2-3	34	16.7	14.7	2.4	1.3	10	4	7	570
1-28	28	14.0	13.0		1.3	5	11	19	675
1-13	13	3.6	1.8		1.7	5	4	15	570
1-12	12			6.5					
<u>1970</u>									
12-9	343	12.2			0.6	5	4	13	530
11-1	306	10.5			0.6	5	9	28	790
10-28	301	10.4			0.8		6	12	515
10-26	300	11.1			0.4	5	3	11	540
10-21	294								470
10-20	293	7.3	6.2		2.0		9	24	540
10-19	292								545
10-15	288	14.0			1.2				560
10-12	285	13.9	12.6		2.5		14	42	550
9-30	273	11.6			1.4				610
8-26	238	10.8				5			505
8-24	236		10.8			5			1180
8-19	231	19.8				5			570
8-17	229	9.3			0.2	5			500
8-12	224				0.1	5			
8-11	223					5			
8-10	222								490
8-5	217								695
8-3	215								735

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 5 (CONTINUED)

1970	Day	COD		BOD as mg/l	Turbidity J.T.U.	Color Units	Analysis as mg/l			Total Dissolved Solids
		Total	Dis- solved				Volatile Suspended Solids	Susp. Solids		
7-22	203									580
7-20	201									440
7-15	196									565
7-13	194				0.3					620
7-9	190									555
7-5	186									540
6-28	179									595
6-25	176									400
6-23	174				0.2					580
6-21	172									520
6-18	169									470
6-14	165									
6-4	155									
5-21	141									
5-19	138									
5-14	134	6.9								420
5-13	133	5.0								580
5-11	131	1.9								650
5-10	130	3.6								990
5-6	126	7.0								580
5-5	125	1.3								525
5-4	124	0.0								645
5-3	123	0.5								1430
4-28	118	0.0								600
4-27	117	1.5								550
4-26	116	5.4								595
4-23	113	0.0								556
4-22	112	0.6								552
4-21	111									552
4-20	110									
4-19	109									1225
4-16	106	20.0								564

TABLE D-4 ELECTRODIALYSIS DEMINERALIZER EFFLUENT, COMPOSITE
SAMPLES, PART 5 (CONTINUED)

1970	Day	COD		BOD	Turbidity	Color	Analysis as mg/l		
		Total	Dis-				Volatile	Suspended	Total
		as mg/l	solved	as mg/l	J.T.U.	Units	Solids	Solids	Dissolved
3-18	77	0.0							620
3-12	71	1.4							536
3-11	70	2.6							456
3-5	64	4.4							632
3-4	63	4.4							612
3-2	61	4.1							560

APPENDIX E

**TABLE E-1 IONICS RECOMMENDED OPERATING PARAMETERS FOR THE
ELECTRODIALYSIS DEMINERALIZER**

Feed Water Temperature °F/°C	70/21
Product Water Conductivity micromhos/cm	730
Diluting Stream Flow-gpm	31.5
Concentrating Stream Make-up flow-gpm	6.0
Pressures-psig	
Feed Pump Discharge	56
Before Polishing Filters	46-53
After Polishing Filters	45
Diluting Stream Influent	18
Diluting Stream Effluent	2.0
Diluting/Concentrating Stream	
Differential Influent	0-1.5
Differential Effluent	0-1.5
Cathode Electrode	
Cathode Influent	16
pH Cathode Stream Influent	1.6
pH Concentrating Stream Influent	5.3
DC Voltage Stage 1	124
DC Voltage Stage 2	95
DC Amperage Stage 1	16.6
DC Amperage Stage 2	8.3

TABLE E-2 ANALYSIS BY THE ADVANCED WASTE TREATMENT RESEARCH LABORATORY (6/14/71) OF ELECTRODIALYSIS INFLUENT AND EFFLUENT BEFORE HANDCLEANING

Test	Electrodialysis Influent mg/l	Electrodialysis Effluent mg/l
Sodium-Na	251.	141.
Potassium-K	19.5	8.4
Calcium-Ca	155.	51.
Magnesium-Mg	1.6	0.6
Ammonia-N	0.4	0.2
Nitrite-N	0.1	0.1
Nitrate-N	21.8	7.0
Total Keldjahl-N	0.8	0.6
Iron-Fe	0.1	0.1
Aluminum-Al	1.0	1.0
Copper-Cu	0.1	0.1
Chromium-Cr	1.0	1.0
Manganese-Mn	0.1	0.1
Zinc-Zn	0.1	0.1
Mercury-Hg	0.2*	0.2*
Sulfate-SO ₄	350.	210.
Chloride-Cl	257	77
Bicarbonate-HCO ₃	140	65
pH (units)	7.1	6.9
Phosphate-P	0.3	0.3
Total Dissolved Solids	820	480
Turbidity (J.U.)	1.5	1.2
COD	16.0	11.5
TOC	4.2	4.4
Cadmium-Cd	0.1	0.1

*parts per billion

TABLE E-3 ANALYSIS BY THE ADVANCED WASTE TREATMENT RESEARCH LABORATORY (7/1/71) OF ELECTRODIALYSIS INFLUENT AND EFFLUENT AFTER HANDCLEANING, AND DEPOSITS FOUND ON THE MEMBRANES

Analysis as mg/l

Test	Influent	Effluent	Deposit	
			Dilute Side of Anion Membrane	Dilute Side of Cation Membrane
Sodium-Na	256.	104.	148.	358.
Potassium-K	20.	6.4	9.8	35.
Calcium-Ca	131.	40.	103.	88.
Magnesium-Mg	2.9	1.1	31.7	16.6
Ammonia-N	7.9	2.5	3.0	12.9
Nitrite-N	1.6	0.5	---	---
Nitrate-N	7.0	1.4	---	---
Total Kjeldahl-N	9.2	3.1	26.1	36.8
Iron-Fe	0.1	0.1	1.2	2.8
Aluminum-Al	1.0	1.0	106	7.0
Copper-Cu	0.1	0.1	0.8	0.9
Chromium-Cr	0.1	0.1	0.1	0.1
Manganese-Mn	0.1	0.1	0.2	0.2
Zinc-Zn	0.1	0.1	0.3	1.6
Mercury-Hg	2.0*	0.8*	---	---
Sulfate-SO ₄	380	200	380	440
Chloride-Cl	260	60	160	360
Bicarbonate-HCO ₃	140	55	150	244
pH (units)	7.8	6.9	7.2	7.4
Phosphate-P	0.5	0.3	44.2	6.5
Total Dissolved Solids	1160	460	1050	1510
Turbidity (J.U.)	1.7	1.7	95.0	55.0
COD	22.2	12.3	393	395
TOC	5.8	4.8	102	82
Cadmium-Cd	0.1	0.1	0.1	0.1

*parts per billion

TABLE E-4 POLORIZATION DATA FOR 27 JULY 1970 AND 30 JUNE 1971

First Stage Voltage-volts	First Stage Amperage-amps	Second Stage Voltage-volts	Second Stage Amperage-amps
Polorization Data for 27 July 1970, Day 208 (0800-1200)			
125	17.4	97	8.9
82	12.8	52	5.7
88	13.3	58	6.4
94	14.2	64	6.9
99	14.9	69	7.4
99	15.0	69	7.4
104	15.4	74	7.6
109	16.1	79	8.1
116	16.8	86	8.6
123	17.5	93	9.0
126	17.9	96	9.2
133	18.2	103	9.4
134	18.3	104	9.4
139	19.0	109	9.6
144	19.3	114	9.9
150	19.8	120	10.0
156	20.1	126	10.1
124	17.7	94	9.0
Polorization Data for 30 June 1971, Day 181 (0800-1000)			
124	19.2	95	8.6
131	19.4	102.5	8.8
134	19.6	106	9.0
142	19.8	112.5	9.1
146	20.0	116	9.3

TABLE E-5 POLORIZATION DATA FOR 29 JANUARY 1970, DAY 29

First Stage Voltage-volts	First Stage Amperage-amps	Second Stage Voltage-volts	Second Stage Amperage-amps
Polorization Data for 29 January 1971, Day 29 (0800-1000)			
105	11.5	75	7.1
111	12.3	80	7.6
116	12.8	85	7.9
122	13.1	90	8.2
126	13.5	95	8.5
132	14.0	100	8.8
137	14.3	105	8.9
144	14.9	110	9.2
149	15.1	115	9.4
154	15.4	120	9.6
		125	9.8
		130	10.1
		135	10.4
		140	10.7